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KOPPERS

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AMERICAN
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Vol. CVI, No. 16 NEW YORK, APRIL 14, 1917 Whole No. 3084

Gas in the Printers' Trade

Uses in Connection with Linotyping, Stereotyping and Electrotyping—Processes Described—General Notes on Melting Soft Metals

By GILBERT C. SHADWELL

FIG. 1. TYPE OF ATMOSPHERIC FURNACE IN FREQUENT USE FOR LINOTYPE WORK

The subject of soft metal melting is one of greatest moment to gas men if only for the reason that there is so much business in this direction to be obtained.

Not only does the printer use gas for melting and remelting his linotype metal, but those concerns carrying out stereotyping, electrotyping, etc., can use gas to the greatest advantage.

The present article is intended, therefore, to cover the more important uses of gas in the printers' trade as this is of particular interest. The rest of the soft metal melting work will be dealt with later as there is a wide field for the use of gas in melting the white metals, solder, Babbitts and aluminum besides those industries making "lead" toys such as toy soldiers, battleships, and a host of other industries.

Most of what are usually termed the soft metals are, in reality, alloys, the base of which is lead. The type metals used in the printing business have antimony and tin added to the lead in certain proportions. The effect of adding these metals is to harden the resultant alloy and give it a lower melting point than lead itself, but antimony performs another valuable function in preventing the alloy from contracting when it cools—in fact, there takes place a slight expansion when antimony cools. Tin is a valuable adjunct as it acts somewhat in the nature of a binder as well as causing the alloy to possess a clear bright appearance.

The Linotype Machine

Almost every printer of any size has in his shop a linotype or similar machine. By its aid each line of type is cast into what are known as "slugs." A large amount of printing is done direct from these slugs which are set up in forms. Those cases using other methods will be considered later.

In casting the slugs a small furnace of 100 lb. capacity or so is used. This is usually supplied connected to the machine. After the slugs have served their purpose they are melted down in a remelting furnace and cast into small pigs or ingots for use in the small linotype pot again.

There are several sizes and styles of remelting-furnaces in use. Sizes commonly used have a capacity from about 250 lb. to 1,000 lb., although both the smaller and larger sizes are occasionally used.

The following data is typical of these furnaces:

Capacity Pounds	Dimensions. Pot Height	Pot Diameter	Pot Depth	Cons. Cu. ft. per hr.	Shipping Weight lbs.
100 A*	15″	9″	6″	40	50
250 A	29″	13½″	8″	75	160
250 F	29″	13½″	8″	100	160
250 P	29″	13½″	8″	125	160
1000 A	31″	20″	13″	150	390
1000 F	31″	20″	13″	200	390
1000 P	31″	20″	13″	250	390
2500 A	33″	26″	16″	275	610
2500 F	33″	26″	16″	325	610
2500 P	33″	26″	16″	375	610

*Note.—A = Atmospheric; F = Fan Blast; P = Positive Pressure Blast.

Fig. 1 shows a type of 1,000 lb. atmospheric furnace in very wide use. This type of furnace as well as the

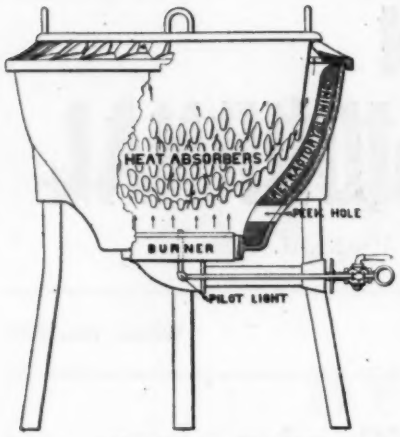

FIG. 2. PROJECTIONS INCREASE HEAT-ABSORBING SURFACE AND INCREASE SPEED AND EFFICIENCY

250 lb. size furnaces have cast iron bodies. Their shapes conform with the shape of the pots. The outer body of the 2,500 lb. furnace, on the other hand, extends clear to the floor, but the flame is not permitted to expand unduly, for an inner lining keeps the products of combustion close to the sides of the pot during their entire journey from the burner to the top ring of the furnace.

Preventing Loss of Heat by Radiation

A highly refractory lining of a special composition of heat insulating properties is placed in the furnace bodies to reduce the loss of heat by radiation, and to protect the operator from discomfort when using the furnace. The shape of this lining is so designed that the heat is reflected in the proper direction and the flame is held to the pot. The combustion chamber should always be of the proper size to allow perfect combustion of the gas.

The pots used for this work should be very durable. They should be made of best iron and reasonably thick. If they are round the strain is kept from acting directly on the bottom and the pot will not crack easily when expansion takes place during heating.

The pots of the furnace shown are provided with teat-shaped projections which greatly increase their heat absorbing surface and naturally increase the speed and efficiency. This is seen clearly by reference to Fig. 2. A pouring lip is, as a rule, cast on every pot for convenience in pouring the metal. The 100 lb. pot will be noted as being equipped with lifting bale and tipping handle, all other pots having loops at the top to facilitate handling.

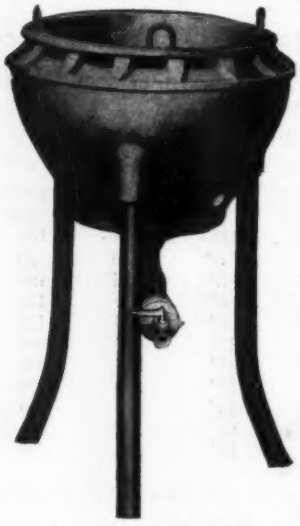

FIG. 3. HEATED PRODUCTS OF COMBUSTION CARRIED CLEAR TO TOP OF POT IN THIS FURNACE

An important principle of design which can easily be embodied in either gas or converted coal furnaces is the manner of conveying the heated gases of combustion clear to the top of the pot by means of raising the pot above the jacket. This arrangement causes the pot to be heated evenly all over so that the upper surface of the metal may be brought to the required temperature without overheating the metal at the bottom of the pot. This is a matter of the greatest importance. Moreover, the speed of the furnace is increased by having the pot uniformly heated; and the gas consumption is further decreased by virtue of the added heating surface which is available.

FIG. 4. 250-LB. FURNACE EQUIPPED WITH HOOD

Hoods are often used to carry off smoke and fumes from the molten metal as well as all the flue gases.

Hoods protect the metal from the oxidizing action of the air. They should be strongly made of sheet steel. They are usually supplied in both conical and cylindrical shapes.

A 250 lb. furnace is shown in Fig. 3, and a cylindrical hood for use with such a size of furnace is shown in Fig. 4.

Fig. 5, shows a 1,000 lb. furnace with a conical hood.

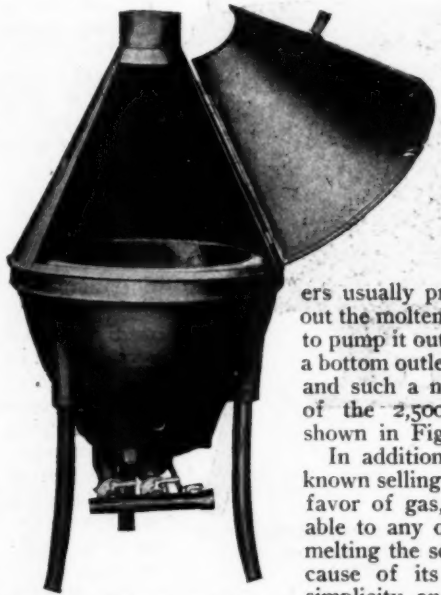

FIG. 5. 1000-LB. FURNACE EQUIPPED WITH CONICAL HOOD

Printers usually prefer to ladle out the molten metal or else to pump it out, but at times a bottom outlet is preferred and such a modified form of the 2,500 lb. size is shown in Fig. 6.

In addition to the well-known selling arguments in favor of gas, it is preferable to any other fuel for melting the soft metals because of its convenience, simplicity and cleanliness. It may be lighted at a moment's notice. The close regulation of the heat makes it possible to melt the metals quickly, and to maintain the furnace at any desired temperature, which reduces the oxidation.

Not only can the furnaces described be used for remelting type metals, etc., but they are especially adapted to other soft metals including the melting of tin, babbitt metals, lead, solder scrap, white metal, die casting metal, etc., most of which may usually be accomplished with an atmospheric burner, no blast being necessary.

They are also perfectly adapted to oil tempering work, lead hardening and tempering.

Aluminum melting, and cyanide hardening require blast burners.

FIG. 6. 2500-LB. FURNACE EQUIPPED WITH BOTTOM OUTLET

The two intermediate furnaces (250 lb. and 1,000 lb.) are the most appropriate sizes for these purposes.

The choice between blast and atmospheric burners depends upon several considerations. Blast burners must be used where the finishing temperature is high as in the case of melting aluminum, and in cyanide hardening. The temperature in these cases is approximately a low red heat.

However, where an air blast is not necessitated by the temperature required, the choice of burner depends mainly upon the degree of rapidity with which it is desired to melt the metal.

A positive pressure blast is recommended for those cases where air at 1 lb. pressure or more is already installed, or where other conditions call for it. The fan blast, however, is the most desirable form of blast to use.

When used for remelting type metal an atmospheric furnace is all that is usually required.

It must be remembered that there is a difference between the various classes of soft metal which will make some variation in the time required to melt them down. The following data is given to show how approximate figures may be determined and what gain in speed may be expected from blast burners. These figures of course do not apply to aluminum.

The pot of the 1,000 lb. furnace will contain, when full, between 350 and 400 lb. of ordinary linotype "slugs." This charge may be melted and the operation of pouring begun in less than 30 minutes after lighting the furnace, with an atmospheric burner.

Such a furnace will melt from 5 to 6 lb. of metal per cubic foot of gas burned (with an atmospheric burner), therefore 100 cu. ft. of gas will melt from 500 to 600 lb. of metal.

If the burner has a capacity of 150 cu. ft. of gas per hour, (see 1,000 lb. furnace) 500 lb. of metal can be melted in 35 to 40 minutes.

One thousand pounds of metal can be kept melted with approximately 45 cu. ft. of gas per hour with this type of burner, but, of course, the amount varies according to the composition of the metal and the kind of gas used.

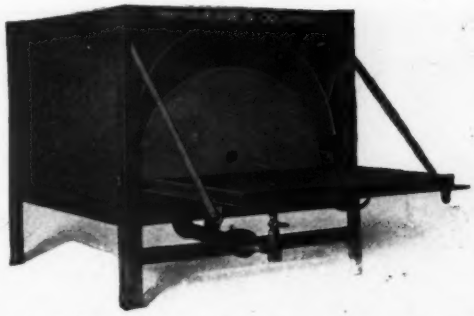

FIG. 8. USUAL TYPE OF MATRIX SCORCHING OVEN IN USE

If the furnace is equipped with an economical fan blast burner, with a capacity of 200 cu. ft. per hour (see 1,000 lb. furnace) the same amount of metal (500 lb.) may be melted in from 20 to 25 minutes. By burning gas at a higher rate the metal may be melted even faster.

An atmospheric burner is ample in most cases, and

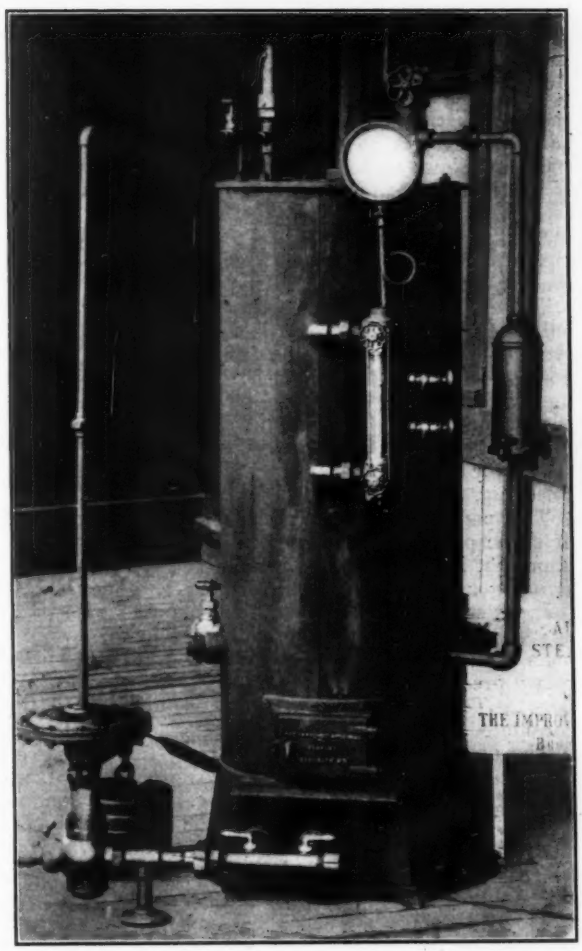

FIG. 7. GAS-FIRED STEAM BOILER FOR USE IN STEREOTYPING WORK

FIG. 9. REGULAR FORM OF STEREOTYPING FURNACE IN ACTUAL OPERATION

it is to be preferred, wherever it can be used, on account of its simplicity.

Stereotyping

Many newspapers have adopted the stereotyping process and it is of the greatest importance to us as gas men, because it is a perfectly legitimate field for gas, and there is no other fuel gas which gives such speed or allows of so easy heat control. Moreover, it is so convenient and reliable and almost every printer recognizes this fact.

Briefly, the stereotyping process is a convenient method of reproducing the "set up" or "form" of a newspaper or other page of type in one solid plate.

The type (as made either by a linotype machine or in any other way) is placed in a steam heated matrix press or "table" and on top of this type is laid a composition of damp paper which is then pressed on to the type leaving a paper mold the exact (inverted) reproduction of the original type. The steam heat thus gives a preliminary surface drying to the matrix. This steam press finds a use for a gas-fired steam boiler (See Fig. 7).

This paper mold or matrix is made of many sheets of tissue paper pasted together. The paste is the all-important item involved as it must be capable of withstanding a high temperature without burning.

In order to permanently dry the "matrix," or "mat" as it is often called, it has to be heated further. Some mats are left flat, but those used in conjunction with a rotary press are round (two semi-circles forming a full page). The latter, being in most common use, will be considered first.

The usual type of matrix-drying, or matrix-scorching oven as it is usually termed (to differentiate from the steam table), is shown in Fig. 8. The mat is placed face down on the saddle of the drying chamber, *so that all moisture is driven from the face through the back of the mat.* This is the proper and only correct method of scorching matrices.

The matrix is held in position by the shield shown in the picture, the raising and lowering of this shield being controlled automatically by the opening and closing of the oven door. The act of opening the door raises the shield to a point 3¼ in. above the outer surface of the saddle of the drying chamber, giving ample space for inserting the mat without damaging its face or edges. When the door is closed the shield descends to within ⅛ in. of the surface of the saddle holding the matrix in place and setting it in semi-circular shape, which makes it much more convenient for placing in the casting mold and less liable to crack or scale than if dried flat and curved afterwards.

A regular form of sterotype furnace is shown in actual operation in Fig. 9. The furnace will be observed to be heated with fan-blast gas burners. It is fitted with thermometer and hood with raising and lowering gear. Fan blast has been employed, as is usual in such cases, in order to obtain speed of operation. The matter of burner equipment for new furnaces and those converted from coal fuel will be dealt with later.

Casting Plates.

At the side of the furnace it will be observed that the operator is casting a flat plate from a (flat) matrix.

FIG. 10. SPECIAL CASTING BOX FOR STEREOTYPING FORMS

In casting plates the dried matrix is fastened in the casting mold, or "box," shown and the metal is poured into it. In this case it is being done by hand, but often a gauged pump is employed. During this process the "box" stands upright, but while the matrix is being placed in position it lies horizontally, a swivel mounting enabling it to be readily turned. After time has been taken to allow for solidification the cast is taken out, stripped from the "mat," and adjusted on a finishing saddle, where a machine cuts off the superfluous metal from its upper end and forms a bevel by which it can be clamped onto the press. It is then placed face downwards in another machine, which shaves out and smooths its interior surface, and finally it is set face upwards for the removal of superfluous protruding metal which might take ink and print when it finally reaches its destination—the printing press.

Fig. 10 shows a special casting box for forms in greater detail. This is fitted with a special atmospheric burner having a consumption of 75 cu. ft. of gas per hour. The reason for the burner in this particular case was that this special casting box was of extra heavy construction and unless heated did not cast well. It required one-half hour to heat with gas, but formerly was heated with gasoline in 40 minutes with 10 cents worth of gasoline at 22 cents per gallon.

The whole of the casting and dressing operations are sometimes performed by means of an "autoplate" machine. As this has no special bearing on the gas end of things other than contained in the above descriptive matter, it will not be considered further.

Fig. 11 shows a curved mat locked in position ready to be turned vertically against the box for casting. In this case it will be noted that the metal is pumped into the box from the furnace. Note also that this is a furnace converted from coal and is operated with fan blast.

Fig. 12 shows a side view of another installation, where fan blast is also employed, the furnace also having been converted from coal. In this picture the finished plate can be seen ready for dressing.

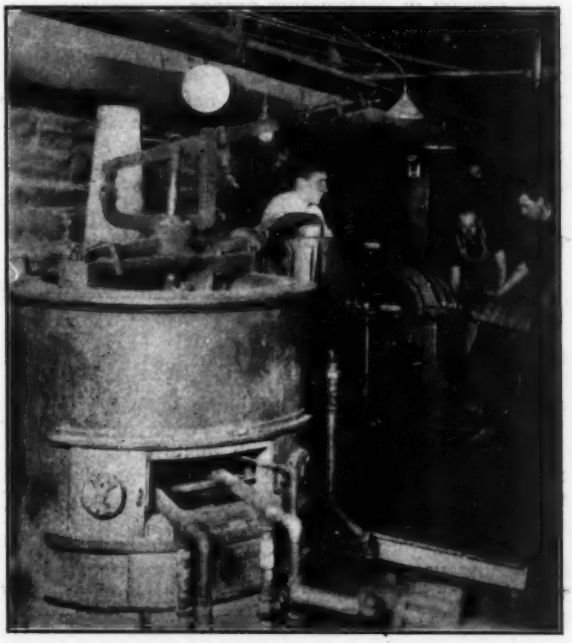

FIG. 12. COAL FURNACE THAT HAS BEEN CONVERTED TO GAS

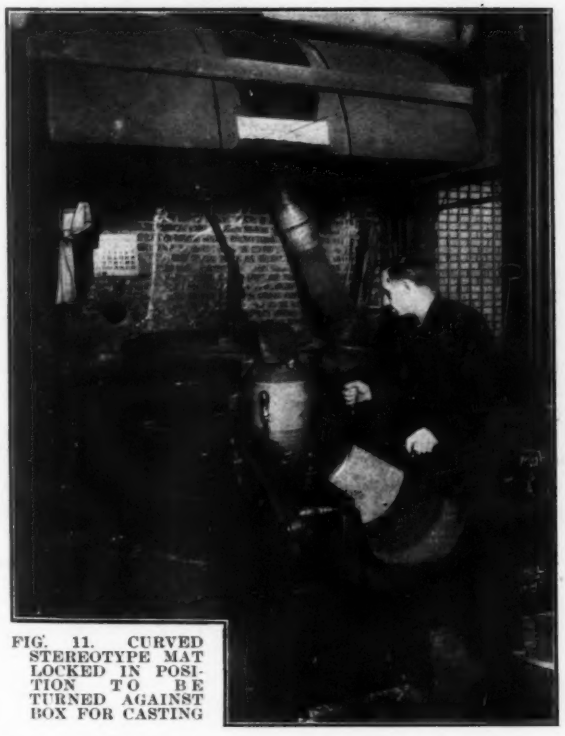

FIG. 11. CURVED STEREOTYPE MAT LOCKED IN POSITION TO BE TURNED AGAINST BOX FOR CASTING

Care should be taken not to heat the pot too quickly, and do not allow its temperature to go too high. Too high a temperature spoils the soft metals. Six hundred degrees Fahrenheit is usually quite high enough.

It will be of interest in this connection to state that an 8,000 lb. round stereo metal pot will usually keep melted for about five hours by its own heat when its temperature has been raised to around the temperature cited.

To convert a coal furnace to gas, take out the grate and set the burner on the floor. If necessary, take off the heads and replace them when the base has been slid into position.

Larger groups of burners are sometimes required, as stereotype furnaces are built up to about 8 tons capacity.

In this connection it may interest readers to know that a group of thirty heads is installed under the furnace of the New York *Globe*. As these large sizes are bound to be met with by gas men, this is just cited as an example to show that this business can be easily obtained.

Electrotyping.

The subject of electrotyping provides another big field for the gas man in so far as the melting of the metal is concerned.

Before dealing with that phase of the subject an explanation of the chief points of the process involved is an important item to be given.

The object of electrotyping is to obtain duplicates of half-tone cuts, line cuts, printed matter, etc. The method usually adopted is to take a wax cast of the half-tone or other cut; the wax is then coated with powdered graphite. This wax mold is then electroplated with a thin layer of copper. The copper when

(*Continued on page* 374)

Tempering of Steel by Oil Bath Insures Uniform Heating with No Chance to Overheat

Human Element of So Much Moment in Color Method of Determining Proper Temperatures that it Is Doubtful if Correct Results Can Be Obtained in This Way

Tempering is defined as an operation for modifying the degree of hardness of a steel. In other words, it results in relieving the hardening strains caused by sudden cooling and by another transformation in the structure from the austentite, down through the martensite and into the troostite stage. This removes the brittleness of the steel and produces a hard yet tough and ductile specimen, explains W. A. Ehlers in the March *Bulletin* of the National Commercial Gas Association.

Like the other heating operations, that of tempering depends largely upon the quality of the steel, and the subsequent use to which it is to be put. These conditions determine not only the temperature to which the work must be heated, but also the method or process employed to impart heat to the metal and the way in which it must be cooled.

Temperature	Color	Some Uses to Which Tool May Be Put
420 deg. Fahr.	Light yellow	Cutting tools for soft metal
440 deg. Fahr.	Very faint yellow	Cutters for cast iron; hand tools; embossing dies
460 deg. Fahr.	Straw	Hand tools; milling cutters; sheet steel and leather dies
480 deg. Fahr.	Dark straw	Rock drills; forming tools; forging dies
500 deg. Fahr.	Brown yellow	Dies for cold rolled steel; drift pins; machine reamer
520 deg. Fahr.	Brown purple	Tools for wood; coppersmith tools
540 deg. Fahr.	Purple	Surgical instruments; dies for brass stamping
560 deg. Fahr.	Light blue	Axes; hacksaws; springs; screwdrivers
600 deg. Fahr.	Dark blue	Springs, etc., subjected to shock

Oil Bath Most Common Method in Use

Tempering by means of an oil bath is one of the most common methods adopted, and is suitable for most work. It insures uniform heating with no chance to overheat.

The work, while cold, should be placed in a pot containing a sufficient quantity of black tempering (mineral) oil and then the temperature of the oil raised to 500 or 600 deg. Fahr.

Lead baths offer another practical method of heating for tempering. These are used generally where temperatures higher than that of mineral oil with a flash point of 600 deg. Fahr. is required.

This method also ensures uniform heating and is found to be very desirable for spring steel, cutlery, etc.

By using tin in connection with the lead the melting temperature may be changed. About one part tin with two parts lead will produce an alloy with a melting-point of about 420 deg. Fahr.

By increasing the lead content, holding the tin the same, the melting-point may be increased to that of the melting-point of pure lead or about 630 deg. Fahr.

Tempering in Salt Baths Also Desirable Where Over 600 Deg. Fahr. is Required

Sand tempering is another method made use of in small work. Sand is placed in cast-iron pans heated from beneath, and the work, which is generally contained in wire baskets, is completely buried in the sand. This method gives color to the steel indicating the temperature to which it has been brought in the heating operation.

Tempering in salt baths is also desirable where temperatures above 600 deg. Fahr. are required. A bath consisting of sodium nitrate and potassium nitrate in the proportion of three parts sodium to one part potassium will give good results with temperatures above this point.

Air tempering is used where a quick method is necessary for occasional needs. The work is placed on top of a smooth iron plate, heated from below, and is moved about until the proper tempering color appears.

For certain work where a special color is desired, it is better to heat the material in a revolving drum with an abundance of fresh air, and allow it to air-cool. This method will give a good finish to steel when used for certain purposes.

The following table of temperature with its corresponding color is offered as a guide for tempering work when done by the color method.

Influence of Human Element in Color Method of Determining Temperatures

The human element is of so much moment in the color method of determining proper temperatures that it is doubtful whether very correct results can be obtained in this way. Moreover, since the heat necessarily raises the temperature and consequently changes the color of the exterior of the steel before it reaches the interior, it follows that this method is not suitable for all work, especially where it is necessary to modify the degree of hardness throughout the steel for uniform results.

Quenching becomes necessary in the color method in order to prevent heating beyond the desired point.

Tempering in liquid baths will usually eliminate the necessity for quenching and will ensure a thorough heating of the part at the required temperature.

There are many uses to which steel may be put, in which it is subjected to unusual shock, as, for instance, in automobile axles and locomotive parts. For such uses the steel must have a minimum of brittleness and maximum ductility, commensurate with the degree of tensile strength required. Such qualities of the steel are not usually obtained in the ordinary tempering operation. It is therefore, necessary to obtain a toughened steel.

The temperature to which steels should be heated for toughening vary according to the composition of the steel, but for most practical purposes a temperature of not over 1,200 deg. Fahr. is most desirable. In other words heat slowly until the steel begins to show a visible red color in daylight and then allow to cool very slowly.

Nation Dependent on Gas and By-Product Coking Industries for Fillers for High Explosive Shells

Capt. J. H. Burns, of the Ordnance Department, U. S. A., Shows Relation of these Industries to Military Needs of the Nation—High Explosives Constitute Three-fourths of the Ammunition Used in Modern Warfare

The military needs of a nation cover an almost infinite range, for they include not only the men necessary to make up the fighting force and the equipment and supplies of all kinds with which they must be provided, but they include as well the home army, with all its ramifications as to persons and things, which is occupied in the supply of the fighting force, explained Capt. J. H. Burns, of the Ordnance Department of the U. S. Army, in his paper on "The Relation of the Coke and Gas By-Products Industry to the Military Needs of the Nation," presented at the annual convention of the Pennsylvania Gas Association, held this week at Reading.

These steps of preparedness naturally divide themselves into two classes: Personnel, which includes the raising and training of an army and all other details incident thereto with the object of producing in the human part of the maximum machine power; and supply, which covers the procurement and furnishing to the personnel of the required food, ammunition, guns, clothing, medicine, etc.

The two are interdependent, and the one is useless without the other. A great deal is being said and written these days about preparedness, but the point covered is almost always the personnel, the necessity for which, however, I do not in the slightest wish to belittle. The supply is being seemingly neglected, but, thanks really to the unpreparedness of the allies and their necessary purchases in this country, many components of supply are now well taken care of. The personnel has been at peace and has been more or less unaffected by the great war in Europe, but the supply in many respects declared war on the same day that it was declared in Europe and has grown with the war.

That part of supply which the United States must particularly watch is made up of arms, ammunition and equipment, for in ordinary times these materials are not produced, except for purely military purposes, and therefore, the reserve equipment, the raw products, the experience, etc., for providing them are not available. They are also interdependent, but probably the most important of all is ammunition.

Importance of High Explosives

The high explosive shell has become the most common type of ammunition, and I venture that three-

Amounts of Munitions Exported from U. S. Since European War Started

Month of	Cartridge	Gunpowder		Other Explosives	Firearms
1914	Value	Pounds	Value	Value	Value
August	154,080	30,948	16,821	26,336	208,644
September	421,982	193,037	65,465	187,510	201,556
October	1,452,740	90,982	24,395	56,305	692,146
November	1,231,235	63,064	23,027	78,062	1,194,510
December	1,098,875	55,352	27,989	980,685	1,093,158
1915					
January	1,381,970	372,085	129,617	1,059,961	2,156,757
February	1,900,774	73,015	34,884	1,020,904	584,694
March	1,616,626	181,043	65,481	1,081,860	545,716
April	2,648,667	645,690	417,919	2,863,014	464,913
May	3,028,083	1,591,136	1,048,607	4,439,777	1,101,751
June	2,467,378	4,376,677	3,234,549	5,911,186	914,118
July	2,427,761	5,504,772	4,567,929	9,329,303	1,948,717
August	2,284,540	6,653,841	5,296,118	6,967,046	693,413
September	1,412,144	11,183,468	8,026,411	8,743,149	1,047,792
October	2,241,729	9,679,904	7,169,728	16,851,970	556,740
November	1,737,673	20,892,232	16,730,384	13,495,527	1,197,768
December	2,260,734	23,204,516	20,201,180	23,366,260	954,102
1916					
January	3,343,497	12,910,701	10,098,175	12,569,635	1,513,087
February	3,616,702	13,483,939	12,043,610	32,665,681	1,902,020
March	4,174,827	20,063,043	16,868,622	29,159,515	1,568,379
April	3,963,133	26,997,792	22,245,946	29,351,236	1,933,953
May	5,390,715	27,487,570	21,300,333	41,384,610	2,576,447
June	4,230,033	34,759,298	29,187,938	28,484,459	2,173,067
July	4,134,765	35,108,319	28,050,026	38,681,413	3,139,379
August	4,287,617	32,518,535	26,299,669	42,293,211	4,301,042
September	5,788,653	40,173,559	34,886,942	34,515,989	9,259,253
October	6,448,881	20,211,272	15,735,102	27,519,820	4,622,202
November	5,174,062	38,124,884	34,718,981	37,705,275	2,476,750
December	4,551,019	15,215,262	12,349,157	37,845,860	6,659,581
1917					
January	5,115,452	36,767,894	30,567,217	44,965,059	12,704,268
Total 30 months	89,986,347	438,613,830	361,432,222	533,600,598	70,385,932

fourths of all the ammunition used is of this kind. Its use alone enables strong field works and obstacles to be pulverized and the defenders literally blasted from the earth and the way paved for a successful infantry advance.

The Germans were the first to show how this must be done when they made their masterful break through the Russian front at Tarnow-Galice in May, 1915. There they crushed the Russian defenses after four hours' drum fire, expending 10,000 tons of ammunition. But this was mere child's play to later developments. In the Champagne in September, 1915, the French drummed the German lines for seventy hours continuously and the Somme offensive was inaugurated by an overwhelming artillery fire of eight days before any infantry advance.

The fighting force at the front might well be called the right arm of the nation with reference to military needs, and ammunition is undoubtedly the right arm of the fighting force.

As we think over the history of ammunition, we find that the weapon of man, through his centuries of progression, changed from the rock and club of the stone age to the spear and the bow and arrow of later times. On the discovery of gun-powder these gave way to firearms, and later day development has been to utilize these to greatest advantage. The use of high explosive followed from gunpowder and on account of the tremendous power stored up in a small quantity of the former all efforts of the military have been toward its proper utilization.

The efficient use of high explosive represents the highest development of the art of war and is the base on which both the offensive and defensive strength of the nation depends.

Derivatives From Coal Distillation Absolutely Essential

The high explosives on which the United States at present depends as fillers for shell, torpedoes, etc., are picric acid, or one of its derivatives, and trinitrotoluol—both produced from, and only from, the distillation of coal as by-products in coke and gas manufacturing. It is, therefore, seen how absolutely essential to the needs of the country are these by-products. Other explosives in large quantities, such as dynamite, gun-cotton, ammonium nitrate, etc., are, of course, used in land mines, bombs, etc., in which no high acceleration is given to the explosive before it is intended to act. In fact, every kind of explosive is being used in some manner best suited to the explosive and practically to maximum amount to which it can be obtained.

I can give no official estimate of the quantity of these materials required. The accompanying table from the Department of Commerce, however, shows the amounts that were exported from the United States during each month from August 1, 1914, to the latest date for which statistics are available.

From this table it is seen that the value of cartridges exported (which are taken to mean assembled ammunition complete for .30 cal. rifles, 3-in. field guns, etc.) gradually rose from $154,080 in August, 1914, to $5,115,452 in January, 1917—with a total value of exportation for the entire war period of $89,986,347.

Gunpowder weighing 30,948 lb., with a value of $16,821, were exported in August, 1914, and 36,767,894 lb. worth $30,567,217 in January, 1917, with a total during the war period of 438,613,830 lb., and a valuation of $361,432,222.

Other explosives to the value of $26,336, were exported in August, 1914, and to the value of $44,965,059 in January, 1917, the total valuation being $533,600,598 for the entire war period. These explosives probably consisted essentially of dynamite, ammonium nitrate, military guncotton, picric acid and trinitrotoluol. If an average price of 60 cents per pound were assumed, above values would indicate the exportation during the month of January of some 75,000,000 lb. of explosive, as compared to 36,767,894 lb. of gunpowder exclusive of both these materials used in the cartridges.

As another indication of the requirements of powder and explosives, I find from a report of the Department of Commerce that the amount of bleached cotton fibre consumed in the United States in the manufacture of guncotton and explosives of all kinds during the year 1915 was 122,000,000 lb., which should have produced some 180,000,000 lb. of guncotton. During 1916, some 292,000,000 lb. of cotton were nitrated with a probable yield of 438,000,000 lb. of guncotton. During the last quarter of 1916, cotton was being consumed for the same purpose at a yearly rate of 324,000,000 lb. with an estimated guncotton production of 486,000,000 lb.

Enormous Quantities Required

When it is considered that the ordinary consumption by the Army and Navy is some 10,000,000 to 12,000,000 lb. of gunpowder and some 6,000,000 to 8,000,000 lb. of high explosive per year, these figures give some idea of the enormous quantities of powder and explosives that are necessary to carry on a war. Of course, it is not known how much of these materials the Allies themselves are making, but it is safe to assume that they are producing several times the quantities that are exported from the United States. The figures also indicate the importance of high explosives, their ratio to gunpowder being about as 2 to 1.

If the 3-in. high explosive shell be taken as the standard ammunition (and practically all the powder exported is for this gun), we find that the charge of high explosive consists of about one pound of trinitrotoluol and that the propelling charge is 1½ lb. of powder, giving a ratio of the former to the latter of 2 to 3. Applying this ratio to the quantity of gunpowder exported and multiplying by ¾ (to correspond to the estimate that three-fourths of all projectiles are high explosive shell), it is seen that ½ lb. of explosive is required per pound of gunpowder as a shell filler and that some 18,000,000 lb. of trinitrotoluol or picric acid are required per month to keep in step with the powder now being sold. Assuming a yield of 175 per cent., these figures would require 10,300,000 lb. of toluol or phenol per month, or 123,600,000 lb. per year, corresponding to some 17,000,000 gal. of toluol. This quantity does not, of course, include the material required for torpedoes, grenades, bombs, etc.

The estimated production of light oil in 1917 is about 45,000,000 gal. which should give some 30,000,000 gal. of refined benzol and 6,000,000 to 8,000,000 gal. of refined toluol. The estimated production of phenol for 1917 is 25,000,000 to 30,000,000 lb. The output of light oil with all of its derivatives is still on the increase.

If the 1917 production less the peace consumption, assumed as three times our production before the war, were all converted into high explosives, some 300,000,000 lb. of picric acid and T.N.T. could be produced. This would seem to be amply sufficient for the needs of the Government, but it must be remembered that the Allies are purchasing all of this material available, as

is evidenced by the continuing firm prices and the efforts to increase production. And it should also be borne in mind that it is far better to be oversupplied than undersupplied.

Great Responsibility of Coal Distilling Industries

If the present phenol and toluol capacity only were utilized, with the same modifications as above, the output in high explosives would be some 115,000,000 lb., which would just about keep us supplied with shell filler only on our present gunpowder capacity.

No figures are presented on benzol and toluol that might be obtained from coal gas plants, since, generally speaking, the consumers of illuminating gas have not adjusted themselves in this country to the use of a gas that has been stripped of its illuminants. In time of war, this would probably be a military necessity, and it is understood that the European nations were forced to do this in their efforts to increase these oils, with a great deal of confusion to manufacturers and consumers.

In addition to being a base for explosives, benzol can be used as a motor fuel, and in time of war would undoubtedly be called on to a large extent to supply the increased demand for this material. The following is an extract from a paper by F. W. Sperr, Jr.—American Gas Engineering Journal, page 77, Jan. 20 issue—on Recovery of Benzol at By-Products Ovens on this subject:

"Its employment as motor fuel, so far as bulk is concerned, bids fair to surpass any other possible source of demand. Previous to the war, Germany used over 50 per cent. of its benzol production for the operation of internal combustion engines. J. S. Gritchley, president of the British Institution of Automobile Engineers, is quoted as stating that the carburetion of benzol presents no difficulties and that, in actual practice the material gives an increase of mileage of about 20 per cent. over gasoline, affording at the same time 12 to 15 per cent. more power.

Ammonia as Related to Nitric Acid

In addition to the benzol products, the gas and coke industry produces another material that is very vitally associated with the military needs of a nation—ammonia. As every one knows, practically all explosives are produced by the action of nitric acid on some base, such as cotton, toluol, phenol, glycerine, etc., in the presence of sulphuric acid. All of these, except nitric acid are provided for by home production. But at present our only source of nitric acid is sodium nitrate, which must be imported from Chile. The necessity for a means of producing this all important acid that does not depend upon our control of the seas, and our ability to purchase and transport it from Chile is, of course, manifest. This weak link in our chain of defence has been realized by the Government as is evidenced by the quite recent appropriation of some $20,000,000 for the erection of a nitrate plant. There are several possible sources of nitric acid in addition to sodium nitrate—the "Arc Process," the "Cyanamid Process," the "Haber Process," the "Cyanide Process" and from by-product ammonia. Which of these is best, I do not know, but in my opinion the Government should be in a position to use any or all of them to such an extent that there is no possibility of a shortage of nitric acid. The problem is now being studied by the United States and the method or methods selected will undoubtedly soon be made public.

The extent to which by-product ammonia could be depended upon as a base for this purpose has been the subject of much discussion. It has a great many champions and there are a great many others who are not so optimistic as to its value as a source for nitric acid. It is quite generally admitted that nitric acid can be manufactured from by-product ammonia, although the process has not been developed as yet to a commercial basis in the country. The quantity that could be relied upon should, therefore, be considered.

The production of ammonia at by-product coke plants has increased from about 4,000 tons per annum in 1901 to some 48,000 tons in 1915. (Paper by H. G. Porter). In 1916, 325,000 tons (figures by the Barrett Co.) of ammonium sulphate were produced (272,000 tons at coke plants and 53,000 tons at gas plants) with an ammonia equivalent of 81,000 tons. The estimated *production* of ammonia in 1918 is some 135,000 tons (120,000 tons from coke ovens and 15,000 tons from gas plants). (Figures by Semet-Solvay Co.). The estimated *capacity* in 1918 is expected to reach 580,000 (Figures by H. C. Porter) tons of ammonia sulphate

Tables Showing Actual Supply and Demand of Nitrogen Under Differing Conditions

1914 Supply		1914 Demand	
Sulphate of ammonia produced	= 37,700 T.	Sulphate ammonia chem. arts	= 14,700 T.
Sulphate of ammonia imported	= 18,350 T.	Ammonia-refrigeration	= 14,450 T.
Nitrate of soda imported	= 101,200 T.	Sulphate ammonia agriculture	= 30,900 T.
Cyanamid imported	= 4,500 T.	Nitrate soda chem. ind	= 60,600 T.
		Nitrate soda O agriculture	= 40,600 T.
		Cyanamid agriculture	= 4,500 T.
Total	= 161,750 T.	Total	= 165,750 T.

1916 Supply		1916 Demand	
Sulphate ammonia produced	= 56,600 T.	Sulphate ammonia chem. ind	= 21,700 T.
Sulphate ammonia imported	= 4,500 T.	Ammonia-refrigeration	= 12,600 T.
Nitrate soda imported	= 187,200 T.	Sulfate ammonia agriculture	= 23,800 T.
Cyanamid imported	= 11,500 T.	Nitrate soda chem. ind	= 155,600 T.
		Nitrate of soda agriculture	= 31,600 T.
		Cyanamid agriculture and arts	= 11,500 T.
Total	= 259,800 T.	Total	= 256,800 T.

or 145,000 tons of ammonia. And the industry is still increasing.

The consumption in this country in 1914 and 1916 is shown in the foregoing table—taken from paper, "Our Nitrogen Demand and Supply in Event of War" in December, 1916, volume of *Journal of Industrial and Engineering Chemistry*.

The estimate for 1918 (war conditions) in same paper is as follows:

1918 Supply		1918 Demand	
Sulphate of ammonia to be produced	= 77,200 T.	Sulphate of ammonia for chem. ind	= 24,300 T.
Deficiency	= 231,850 T.	Ammonia for refrigeration	= 14,750 T.
		HNO_3 for government. explosives	= 55,000 T.
		Nitric acid for maintenance of present chemical industry	= 156,000 T.
		Inorganic nitrogen for fertilizers	= 59,000 T.
Total	= 309,050 T.	Total	= 309,050 T.

If above figures were taken as the true measure of the needs of the country in time of war, and they seem to allow for only a 35 per cent. increase in the amount of explosives over the 1916 production, the nitrogen from the coke and gas industry could not be relied upon to supply the nation. But even in this case it would supply 39 per cent. of the total nitrogen required by the United States covering in full the demands for sulphate of ammonia for the chemical industries and the demands for fertilization and refrigeration and still leaving a surplus that could be used for nitric acid.

If it were assumed that the year 1916 really found us at war, so far as the nitrogen industry is concerned, and that the consumption of that year could be taken as a criterion of the war-time demands, 48 per cent. of the total nitrogen requirements would be met with by-products ammonia.

Fertilizers Needed

The large increase in the demand of nitrate of soda in 1916 over that of 1914—95,000 tons of nitrogen—should be noted. This was probably used mainly in the manufacture of explosives for the Allies, and would tend to indicate that the estimate credited to the Government for war-time needs of 180,000 tons of nitric acid—40,000 tons of nitrogen—is low.

H. C. Porter, in the February, 1917, issue of the *Journal of Industrial and Engineering Chemistry* disagrees in part with the figures of above tables and gives this estimate of nitrogen demands.

"Estimate of the Imperative Demand for Inorganic Nitrogen in 1918 (exclusive of Export Products and Fertilizers).

	Tons of Nitrogen
Ammonia for the chemical industries and refrigeration, 21,633 (1914 consumption) × 1.36 (growth of ind.)	= 24,421
Sodium nitrate for the chemical and allied industries (not including explosives) 12,674 (1914 consumption) × 1.16 (growth of industry)	= 14,702
Sodium nitrate for industrial explosives, 29,790 (1914 consumption) × 1.05 (growth of ind.)	= 31,279
Total industrial demands for ammonia and nitrate	= 75,402
If to this should be added fertilizers	59,000
and the government estimate of nitric acid	40,000
we would have a total of	174,402

of which by-product ammonia could supply 68 per cent. and, if fertilizers were greatly reduced, it could supply the above estimated demands of the industries and the Government estimate for nitrogen in munitions with a small surplus.

Any scheme, however, that contemplates the reduction of fertilization is open to criticism, for in time of war it is necessary to produce more crops per acre and per man than at any other time. If it were not for fertilization, Germany would undoubtedly have been forced to give up before this. The following quotation from an address made by Senator Page in the first session of the Sixty-second Congress on this subject is of interest:

"In 1907 Germany had 43,000,000 acres sowed to wheat, barley, rye, oats and potatoes, and harvested therefrom 3,000,000,000 bushels. While from 85,000,000 acres sowed to the same crops in the United States, American farmers harvested only 1,875,000,000 bushels. In other words, from less than one-half the area, German farmers harvested double the number of bushels." And the answer lies chiefly in the intelligent and abundant use of fertilizer.

But in any case the immense value of the supply of by-product nitrogen on which the Government must draw is very apparent. And if to this be added the absolute dependence that must be placed on the coke and gas by-products industry as a source for explosive bases, and even though the many remaining by-products are ignored, the relation of this industry to the military needs of the nation is seen to be paramount.

Paying Domestics to Learn Cooking by Wire

At least one electric company is going to unusual efforts to widen the use of the electric range. The practice of the St. Louis company is a striking illustration. In its newspaper advertisements it features the fact that its cooking school is being conducted by Mrs. Margaret M. Williams Winn, a well-known domestic science expert. As an incentive for cooks and servants to attend the classes regularly the following offer is made:

To all who attend the classes regularly and complete ten lessons in addition to a diploma a cash reward of $7.50 will be given. In other words, not only are these women and girls to be given instructions that will make it possible for them to seek and find positions which will enable them to earn more money, but they are paid at the rate of 75 cents per lesson for attending the school. The names of all graduates will be kept on file by the company for the information of those who may inquire about cooks qualified to cook by wire. Though the company distinctly states that it will not act as an employment agent, many cooks will be able to secure places through having their names on the company's files.

The Paris Gas Embargo a Reality

How the Companies Were Compelled to Cut Consumer Consumption, Reconciling Three Opposing Factors by Government Decree—A Possible Opportunity for Manufacturers of Water Gas Equipment

By FRANCIS MILTOUN

We have just come to the end of the first forty-day period, when the Paris gas subscriber has come to know his fate. He might, at least, have made a guess had he known how to read his meter, but that accessory is still a mystery to more Paris householders, who believe, if they have any belief in it at all, that it is some sort of lying contraption working in the companies' interests whether gas is burned or not.

Gas, like sugar and cakes and tarts, is now rationed to the Paris dweller. You are allowed of gas only a quantity based on your consumption for the same month in 1915 (or, if you prefer, you may elect for a base as of 1913, the year before the war). If you exceed your allowance your supply is cut off for ten, twenty, thirty, or forty days, according to the volume of the excess. There is even an extreme penalty which covers the period extending to "the end of the war" should you exceed your allowance by 100 per cent.

If your gas is once cut off these days there is no assurance that it will be turned on again promptly. Probably it will not be. The expiatory period thus becomes indeterminate whatever be the extent of your offending.

A Government Measure to Save Coal.

Hence the government's plan for saving the national coal supply has worked wonderfully, even beyond expectations. And scarcely anyone is to be found who complains, though manifestly the inconvenience has been great.

This has also resulted in a falling off in the production of tar products—benzol, toluol, and other derivatives so necessary for the manufacture of explosives and the artificial dye industries. How this *vide* has actually been filled the censor will not permit to be discussed, even hinted at, if this communication is to be allowed to pass through the mails.

Small companies in the country probably made little or no effort to recover these by-products, but their manipulation was a big factor in the profits in the Paris area, where the Société de Gaz de Paris was selling gas that cost 5.6 cents a cubic meter to manufacture for a bare 4 cents to the consumer. There must have been a silver lining somewhere.

Even before the war some 2,000 Paris auto-taxis were running on benzol, which must have come from somewhere, offering a good margin of profit, too, in competition with gasoline, which within the gates of Paris has always been 50 cents or more a gallon, and in these days is nearly a dollar.

A Unique Situation in Gas-Producing Annals

Follows, the procedure and the achievement of what is perhaps a unique situation in gas-producing annals:

Without the prime materials, the *matière brut*, gas cannot be produced, an observation trite but true. Even the lay Parisian, after his attention was called to the matter, accepted this for fact.

In January various sectors of the lines of the company producing gas for *la ville lumière* had not a week's supply of coal ahead of them. Versailles got down to four days, then one day, and then stopped abruptly for forty-eight hours.

The Seine, by which supplies of coal for the Paris region are received from down-river and channel ports, was one week in flood, the next practically frozen over.

There were 1,200 barges of from three to seven hundred metric tons of coal-carrying capacity each tied up at Rouen, 150 miles below, and probably a hundred thousand tons afloat in deep-sea colliers in the lower river and in the roadstead at Havre.

Railway transportation, owing to the demands of national defense, was practically at a standstill.

Truly the situation was, if not serious, at least complicated for the Parisian to the habit born, who likes his flood of light (electricity was under a similar ban), to say nothing of the cooking and heating demands; the latter practically blinked out because of the shortage.

Personal Experience.

According to the decree of the Paris préfecture of police, my own modest consumption of normally about 120 cubic meters per month (4 cubic meters per day) was to be cut to a bare 1.8 cubic meters for the two rounds of the clock. This was according to the same printed formula which was handed to every householder, though not one in a thousand could conscientiously say that he could make either head or tail of it. There was to be allowed also one-fifth of a cubic meter per day in addition for the sole other member of my family, plus a tolerance of 10 per cent. in addition in case our figuring might be at fault.

The period between meter readings was henceforth to be forty days, which changed nothing of the fundamental principles of the formula; this latter owing to a shortage of the personnel of the company, due to mobilization.

Strictly following the formula I should have been allowed 72, plus 14.4, plus 7.2, equalling 95.6 cubic meters for the period. What I actually got, as allowed by the rather vaguely worded "permit of consumption," was 75, plus 15, plus 7.5, equalling 97.5 cubic meters, rather less than five-sixths of my normal consumption. This was not so bad, and no great inconvenience resulted.

Others fared less fortunately, and in the absence of an otherwise adequate coal provision for the domestic uses of cooking and heating some may actually have suffered. On the whole, I should say that the company performed its part admirably; the situation was not of its making, and it was but following out a government decree.

Big Reduction in Coal Consumption.

Some months ago a council of the ministers of state had decided, upon the strength of arguments presented by the military authorities, that a diminution in the use

(*Continued on page 375*)

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CONSTRUCTION NOTES WILL BE FOUND ON PAGE 16 OF THE ADVERTISING SECTION.

Meeting the Needs of the Hour

The gas industry, after many months of discussion, and, in many cases, silent preparation, is confronted with a situation it has long expected.

Now more than ever the conclusions of those foresighted men who have been planning for the crisis should be freely explained to the industry. To this purpose the columns of this journal are freely offered.

Besides the contributions the industry must make for the manufacture of munitions, the revelation that this is to be largely a war of food production, has created a wide demand for fertilizer. This places an additional responsibility on the industry.

All gas men will want to be certain that they are doing their full share. Some will be doubtful as to how they can do it. Many of their questions have doubtless already been anticipated by the foresighted men mentioned. If there is anything upon which they desire information this journal will be glad to place all its facilities at their disposal towards obtaining it.

Rapid Depletion of Fuel Resources Not Due to Necessary Consumption

The ability of any nation to carry on a war successfully depends to a very great extent upon its ability to supply from within its borders all the essentials for waging war. What holds true in the state of war also holds true in a less spectacular way in the state of peace. The greater its natural resources, other things being equal, the greater will be the commercial power of any nation. The most important, natural resource is the fuel supply.

The United States is blessed above most other nations with a great abundance of all kinds of fuel substances. We have great forests, large tracts of oil and gas lands and widely distributed and extensive coal deposits.

Our forests already have been cut down to such an extent that any extensive use of wood as fuel has become prohibitive. In fact it is becoming more and more customary for woodworking plants to sell their wood waste instead of burning it, as they all did only twenty-five years ago.

The consumption of oil is increasing so rapidly that it has been estimated that the available supply within our national boundaries will be completely exhausted within a relatively short time. The supply of natural gas will no doubt be exhausted in less time than this.

Basing their estimates upon the present consumption of coal, taking into consideration the enormous waste that is constantly going on, experts are already able to estimate approximately when our coal deposits will be completely worked out.

This rapid exhaustion of available fuel supplies is not due to the actual necessary consumption. It is due rather to the enormous waste that accompanies this consumption. If all fuel is used efficiently all the work that it now does can be done and yet the present known fuel supply be made to last for many centuries longer than at present estimated.

Oil possibly is used more efficiently than most other

fuels. The oil industry has built up an enormous by-product industry and, on the whole, oil is recovered and burned fairly efficiently, yet there is still room for vast improvements.

Natural gas is not only wasted in vast quantities at the wells, but also in distribution and consumption. The waste alone of our natural gas has been estimated as sufficient to supply all our cities of above 100,000 population with all the gas they are now consuming.

The actual waste in coal is even greater than that of natural gas. In former years the waste at the mines was enormous. This, however, is now being cut down. The greatest waste now lays with the consumer. An idea of how great this is can be gained by the fact that according to the best estimates only two per cent. of the heat value of coal is utilized where it is burned in the kitchen for cooking purposes, whereas fully fifty per cent. of the heat value of gas is utilized where gas is used for doing the same work.

The increase in efficiency of first distilling coal and using coke and gas instead of the raw coal for heating purposes is twofold. First the heating value of the coal is applied very much more efficiently if applied through the agency of gas or coke than it is if applied through the agency of the raw coal. Second, by-products of the distillation of coal constitute a wide group of very valuable chemicals.

How important these chemicals have become in time of peace as well as war we have been able to learn during the past three years. In Great Britain and Germany the gas industry is looked upon as one of the most valuable defensive industries of modern life. The strength of this industry has a great deal more bearing than most people imagine upon the successful prosecution of the war.

If one should seriously advocate the burning down of a cottage in order to roast a pig in accordance with the process so ably described by Charles Lamb he would be laughed to scorn. People who use coal for cooking, heating and power purposes when they could as well use manufactured gas are nearly as destructive of our natural resources as they would be if they burned down a small cottage each time they roasted a pig.

The gas industry in urging a more extensive use of gas is not only increasing the dividends of the stockholders but is doing a far greater and more worthy work which is of immense benefit to the nation and to posterity. It is doing its part to conserve our fuel resources, especially our coal supply.

If the gas industry will increase its efforts to supplant the use of raw coal with gas and coke, and to increase the efficiency with which gas and coke is burned by advocating the most efficient appliances our coal supply can be made to last many times as long as the most liberal estimates now being made.

The conservation of our coal fields really lays with gas men more than with any one else. Gas men can greatly improve the efficiency of fuel consumption in the home as well as the factory and when this is done one of the greatest wastes and possibly the hardest to overcome will be largely done away with.

What Determines the Sale of the Domestic Gas Range?

Quite seriously, in objecting apparently to the present-day tendency towards selecting the domestic gas range from the viewpoint of efficiency, a speaker at a recent gathering belittled this feature as a selling point, taking the stand that it is appearance alone that determines the housewife in purchasing her range.

Unquestionably on the face of the matter it is attractiveness in appearance that caps the sale. But is the average housewife as utterly disregardful of the matter of efficiency as this speaker would have us believe? Is not her apparent indifference in this regard due, rather to confidence in the gas company that is selling the range, than to a wilful recklessness in the expenditure of the family funds.

We think that this is the true answer to the question. The opinion of this journal is that it is to the female of the species rather than to the male that economies in so small an item in the family expenditures as the gas bill is, most strongly appeals.

It is our belief that the housewife considers the efficiency of the range as a technical matter beyond her understanding. Her attitude is that she is buying service—and this includes technical service—as well as a range, and she takes it for granted that the gas company will guard her interests in this particular. To her the high-priced range is the best range, not only from the point of beauty but from the point of efficiency as well, and so it should be.

By all means do let us not relax in one iota in making gas ranges as beautiful in appearance as they can be made, but let us also be equally rigid in demanding that they be efficient.

Another speaker at the same gathering brought out that rough tests he had made showed the range burner of twenty-five years ago to be more efficient than the burner commonly used to-day. Whether or not these tests were extensive enough to have any real significance, they should at least serve to call to our attention the fact that there are conditions in the range field that are well worthy of our looking up.

There has been in the past too much buying from the catalogue in our range business. This should be eliminated entirely. The good faith of the gas company is behind every range it sells. It should therefore reduce the purchase of its ranges to a truly scientific basis.

The selection of a gas range for sale by the gas company should not be made a commercial matter. It should be a strictly engineering proposition.

(Continued from page 365)

sufficiently thick is carefully removed and backed with tin. This is done by placing the copper electro in a tray, or backing-up pan, with tin foil at the back and floating it on the molten electrotype metal. This backing-up pan is shown attached to a chain and block above an electrotype furnace in Fig. 13. In Fig. 14 we see the backing-up pan being lowered into the furnace.

FIG. 13. BACKING-UP PAN FOR ELECTROTYPES SUSPENDED FROM CHAIN

This operation causes the tin to alloy itself with part of the copper. After this is done the backing-up pan is raised and placed on a backing-up table having an iron top. It is then further backed up with electrotype metal from the furnace to a total thickness of about ⅛ in., and it is then trimmed up and the back planed. After this it is nailed to a block and is ready for the printer.

Fig. 15 shows the operator backing up an electrotype with electrotype metal.

General Notes on Soft Metal Melting.

In converting coal-fired soft-metal furnaces to gas it is important that a damper be placed in the flue so as to lessen the amount of cold air which will pass up the sides of the pot. Also close the ash and fire doors, only leaving a peek hole for inspection.

In starting up from the cold use a soft flame, so as to avoid cracking the pot. When heat has been applied until the pot is hot enough to start the metal melting at the sides, add more air and gas until a sharp flame is obtained, which should burn down within (*not below*) the ports of the refractory top, making the latter incandescent.

It is always desirable to use a burner group with two or more mixers (where possible), as not only is a wider range of control secured by using one mixer only at starting, but the danger of cracking the pot is considerably lessened. In addition, after heating the metal to the required temperature, only one mixer need be used. This results in every other head only of the group being in operation.

The operation data already given is indicative of general results to be expected from stereotype and electrotype furnace melting, but as a converted coal furnace is never so efficient as a regular furnace built especially for gas fuel, this is likely to be decreased somewhat in such cases.

The conditions under which many newspapers operate their furnaces makes high efficiency a very difficult matter to accomplish.

Speed is universally sacrificed to fuel cost, so that if a burner will give speed of operation this is a factor which will weigh heavily with the customer.

In getting out a newspaper, minutes—even seconds—count, and this point cannot be lightly disregarded.

Some actual figures are of use, however, in obtaining an idea as to the cost of operation.

A stereotype plate and "tail" (the portion of metal which has to be cut off) weighs on an average about 97 lb. The finished plate weighs about 69 to 70 lb.

Using artificial gas of about 600 B. t. u.'s per cubic foot, with a good burner with fan blast, at 1 to 2 oz. air pressure on a converted furnace, will show from 19.1 to 16.5 cu. ft. of gas for the tail and plate; in other words, on dollar gas plates would cost about 1½ to 2 cents each for gas.

But this neither considers the value of the extra speed nor the saving in there being required no storing or handling of solid or liquid fuel with the consequent troubles, to say nothing of the overhead involved by using those fuels. If all of the items considered be taken into account, gas for these purposes would be cheap at any price.

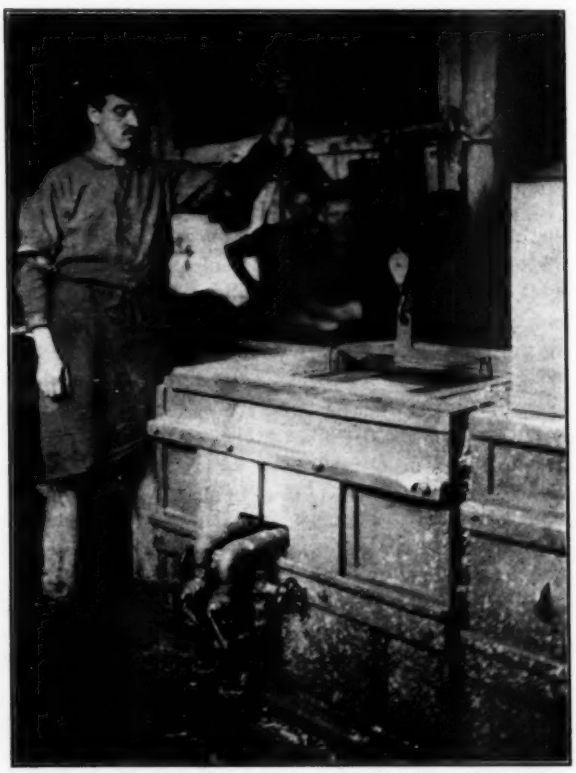


FIG. 14. BACKING-UP PAN LOWERED INTO FURNACE

FIG. 15. OPERATOR BACKING UP PLATE WITH METAL

The largest stereotype and electrotype furnace manufacturer in the world advocates the use of gas. The largest newspapers in the country have changed to this fuel. It is most valuable business, and should be obtained in every city or town.

The Paris Gas Embargo a Reality

(*Continued from page 371*)

of gas and electricity was imperative. Prefects and mayors throughout France had been "invited" (which is the polite French way of putting an official proposition before putting on the screws in case of non-compliance) to diminish by all possible means the use of gas in their circumscriptions.

The result was that during the last six months of 1916 there was a monthly gas coal consumption by private companies of but 120,690 metric tons, as compared with 216,000 tons for the same period during the first year of the war—that is, the daily consumption fell from something like 1,200 tons to less than 700, approximately a reduction of 44 per cent. Deeming this economy insufficient, a régime was imposed whereby the gas production for any one month was not to exceed two-thirds of that of the same month of the winter of 1913-14 in any case.

A formal decree followed, sustained by a "circular" of the Paris préfecture of police, which defined the limits beyond which the consumer might not go for Paris and the contiguous Department of the Seine.

If the representatives of the gas company were present at the conclave which arrived at these decisions it does not so appear.

At any rate, the company was tacitly acquiescent, for the reason, perhaps, that it is looking for an extended charter (the cash required, 20,000,000 francs, to be borrowed from the city of Paris), which will permit it to supply water-gas, a commodity hitherto frowned down by Paris officialdom. Incidentally this may suggest to some manufacturer of such equipment that now might be a good time to go after these Paris gas producers and get some business. The suggestion is made for what it may be worth.

The full text and formula of the new regulations as to the gas régime under which we of Paris are now living is as follows:

Where the daily base for the corresponding month of 1916-17 averaged in cubic meters, the private gas consumption to be allowed for the corresponding month of 1917-18 is in cubic meters: 1 cubic meter in 1916-17, 1 cubic meter in 1917-18, 1.5 cubic meters in 1916, 1.2 cubic meters in 1917-18; 2 cubic meters in 1916-17, 1.4 cubic meters in 1917-18; 2.5 cubic meters in 1916-17, 1.6 cubic meters in 1917-18; 3 cubic meters in 1916-17, 1.8 cubic meters in 1917-18; 3.5 cubic meters in 1916-17, 2 cubic meters in 1917-18; 3.5 cubic meters and over in 1916-17, 2 cubic meters in 1917-18, plus one-sixth of the portion of the base consumption (month of former year) superior to 3.5 cubic meters.

Tolerance of 10 per cent. is allowed for oversight or negligence, plus 20 per cent. in addition for each member of a family exceeding one.

In no case can combined allowance, tolerance, and supplementary allowance exceed 80 per cent. of the former base.

Penalties.

In case the tolerance be exceeded by 11 to 40 per cent., suppression of gas for 10 days; 41 to 75 per cent., suppression of gas for 20 days; 76 to 100 per cent., suppression of gas for 30 days; above 100 per cent., suppression of gas for 40 days.

Suppression to consist of putting the city seals on the offending private meter, the breaking of which, except by an authorized agent of the municipality, to carry with it complete suppression of the gas supply for the period of the war.

Industrial establishments working on contract or otherwise for any government department to be exempt from these regulations, also public bake-shops so far as they may make use of gas for the baking of bread.

All illuminated signs are hereby suppressed.

Theatres, music halls, concerts, and moving-picture shows to be closed for four nights a week.

All shops except those selling foodstuffs to be closed nightly at 7 o'clock.

All restaurants, cafes, and wine shops to be closed at 9.30 p. m.

Little Dissatisfaction Manifest.

Actually, in spite of the psychological and human right of protest on the part of the private individual for which all civilized governments make allowance—war or no war—little opposition was raised to these regulations by the general public; by the gas companies, in view of the general shortage of combustibles and the labor difficulties of operation on a large scale, still less.

In the country the case was complicated for many small companies by the utter impossibility of their being able to continue to furnish illuminant at the hitherto ruling figures as set forth in their original charters—this owing to the high cost of gas coal, of freights thereon, the uncertainty of deliveries, and, lastly, but not least, the labor shortage.

Municipal Ownership Not a Great Success in France.

At St. Raphael, on the Riviera, where I have just spent a fortnight basking in what is supposed to be the finest winter climate in Europe, but which cannot in any respect compare to the excellencies of Florida or Southern California, a representative of the local gas company—not a mere employee, but a director—presented himself to my host, asking if he was willing to pay his last month's gas bill at practically double the figure rendered (50 centimes the cubic meter, instead of 28 centimes—20 centimes at Paris, though the Paris company claims that it cost 28 centimes to produce) and so continue for the length of the war and for twelve months thereafter. Or would he prefer that the municipality should take over the operation of the plant on an arrangement which would leave the price of gas still unregulated, the selling price which the private company would receive for the plant to be put on to local taxes for a period of thirty years.

It might even prove to be worse than that, for he held up the rather tangible bogey of a statement that of twenty municipally operated gas plants in France previous to the war, but three were in operation to-day. "Private initiative can sometimes do the impossible," the French say; "a municipality never tries."

You may argue that things are not thus accomplished. Perhaps they never were before, nor anywhere else, but things are happening every day in Europe in these strenuous times which were never dreamed of before, and the account given is substantially word for word just as the argument was put.

My friend hesitated not a moment; he pyramided at once, and the St. Raphael Gas Company instead of shutting down that night, as it had proposed doing, is still carrying on at the old stand. Whether they are making or losing money, with gas coal at $26 a ton, as compared with $5.60 before the war, and freights from England at from 40 to 50 shillings, as compared with 7 or 8 shillings, is not for me to say. They evidently had an object in holding on, and are in no wise to be criticised for their decisive action, nor are they, for the community seemingly recognizes them as a public benefactor. Which is just what a public service company ought to be. For this it should be allowed to make a decent profit in ordinary times and secured against loss at other times.

Explain Theory of Coking Process in By-Product Oven

C. J. Ramsburg and F. W. Sperr, Jr., Give Brief Outline of Generally Accepted Theory Developed by German Investigators—Interior of Oven Remains Comparatively Cool Up To Advanced Stage of Process

A very concise outline of the generally accepted theory of the coking process is given by C. J. Ramsburg and F. W. Sperr, Jr., vice-president and chief chemists respectively of the H. Koppers Company, of Pittsburgh, Pa., in a paper in the April *Journal* of the Franklin Institute.

The development of this theory is due to several German investigators, notably Muck, Hilgenstock, Rau and Simmersbach, and it has received such abundant confirmation from every practical standpoint that there can be no question of its soundness.

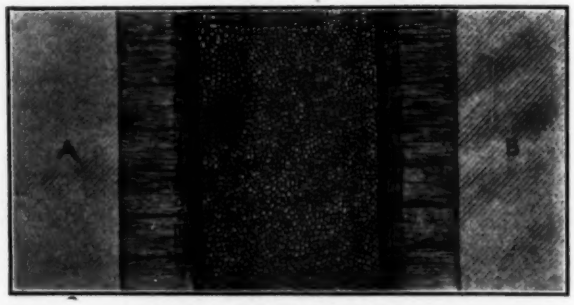


FIG. 1. CROSS SECTION OF OVEN IMMEDIATELY AFTER CHARGE IS INTRODUCED.

Fig. 1 represents a section across a by-product coke oven immediately after the charge of coal is introduced. The layer of coal next to each wall A and B is very rapidly heated. A complicated process of destructive distillation begins, and at a temperature of about 375 deg. to 400 deg. C. the layer becomes soft and pasty. The pasty mass is for a while in a state of violent ebullition, due to the rapid expulsion of its volatile matter, and then rapidly solidifies, the indurated residue retaining the vesicular form and structure of the pasty, foaming stage.

The adjacent layer towards the interior has in the meantime reached the pasty stage, the fusion being assisted by the penetration of some of the soft material forced over from the outer layer.

The gases and vapors follow always the line of least resistance, and pass through the porous outer layer and up along the wall of the oven instead of forcing their way through the viscous inner portion of the fused layer, and then through the mass of coal.

In passing through the highly-heated porous layer, the hydrocarbons undergo a partial secondary decomposition, depositing part of their carbon on the cellular surfaces, just formed, thus building up and strengthening the coke.

The coking process is thus to be conceived as involving the formation of a fused zone, and the gradual advance of this zone toward the centre of the oven, the evolved gases and vapors depositing part of their carbon in the vesicular mass left as the zone progresses.

The condition of the material in the oven when the coking has fairly well advanced may be represented by Fig. 2; c is the portion already coked, d is the fused zone merging into an adjacent zone e, which, being in a state of incipient fusion, is more viscous; f is the uncoked coal.

Thickness of Fused Zone not Over Half Inch

The actual thickness of the fused zone is probably not over one-half inch. The drop of temperature across this narrow zone is very great, and the interior of the oven remains comparatively cool, even at an advanced stage in the coking process.

Simmersbach's experiments on a Koppers oven of 500 mm. (19 7/8 in.) mean width, operating on 29 hours coking time with a final maximum temperature of 1,120 deg. C., showed that the temperature in the middle of the oven, 1 meter above the floor, remained about 10 deg. C. for 2.5 hours after charging; then rose to 100 deg. C., and remained at this temperature until 13 hours after charging. At 20 hours the temperature was only 410 deg.

The rate of advance of the two zones toward the

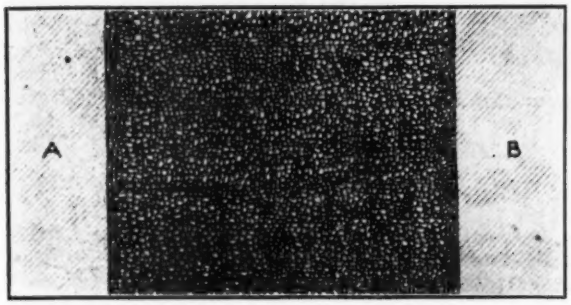


FIG. 2. CONDITION OF MATERIAL WHEN THE COKING IS FAIRLY WELL ADVANCED

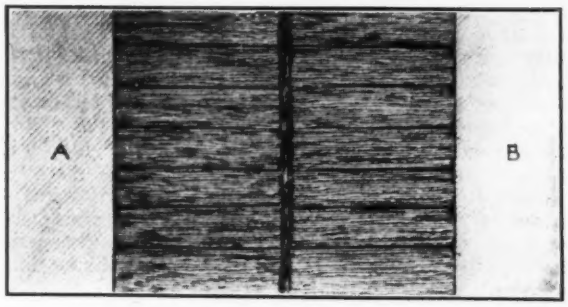


FIG. 3. COKE AT END OF PROCESS

centre of the oven depends principally upon the temperature of the walls (A) and (B). In present practice, with ovens 18 in. wide and wall temperatures about 1,000 deg. C., the average rate is about one-half inch per hour. The initial rate is, however, much more rapid than this, and decreases as the centre of the oven is approached.

As the coking progresses, cracks or joints develop perpendicular to the walls of the oven, thus determining the blocks of coke as they are eventually formed when the oven is discharged. These cracks form avenues of escape for a large percentage of the gases, hence the amount of deposited carbon is greater in proportion on the surfaces of the blocks than in the interior. Eventually the two zones merge at the centre of the oven (Fig. 3), and, with the practically complete expulsion of the last of the volatile matter, the coking process is finished.

There is always a distinct parting in the centre of the oven, so that the length of the blocks is equivalent to about half the width of the oven.

Overcoking and High Temperatures Tend to Produce Small Sized Coke

The shape of the coke is quite characteristic, depending upon the coal from which it was produced, and also, to a considerable extent, upon the method of heat treatment. The coke-oven man classes his product as either "blocky" or "fingery," coke of the former character being preferred. As a rule, the coke from coals of over 30 per cent. volatile matter is apt to have a fingery tendency—and this becomes highly pronounced if the coal has a high oxygen content. By coking such coals very slowly at temperatures somewhat lower than used in ordinary practice, the fingery tendency may be disguised or in many cases entirely eliminated. By disguising it, we mean that the product will actually appear to form large, massive blocks, but these blocks, if closely examined, will be found actually to be bundles of slender pieces more or less firmly cemented together.

However, if the heat treatment be very carefully regulated during the coking process—especially in ovens designed and adapted to this particular type of coals—genuine, firm, blocky coke may be made from many coals usually regarded as producing only the fingery variety.

The size of the blocks is affected to a certain extent by almost all the conditions pertaining to the manufacture of coke. The length is, of course, dependent upon the width of the oven, the average being, on account of shrinkage, a little less than half the width of the oven. The blocks from the tip of the oven are usually (especially with high volatile coals) shorter than those from the bottom. Overcoking and high temperatures tend to produce small-sized coke.

Coming now to an examination of the natural surfaces of the blocks, we may, in the first place, disregard the color as being relatively unimportant. It depends largely upon the method of quenching, and, to some extent on the quality of the water used, the use of large amounts of water causing a dark color, while with the careful use of a minimum quantity of water a light gray color can always be preserved.

The majority of cokes produced from the standard coking coals rich in hydrocarbon production and low in oxygen have close-textured, even surfaces, with possibly a few narrow, transverse zones of slightly larger cell openings interspersed between the two extremities. Many cokes from coals of the Connellsville (Pa.) type show the same silvery, glossy skin that used to be so much prized in beehive coke. This is probably indicative of a very heavy deposit of carbon, especially favored by slow and uniform evolution of a very rich gas.

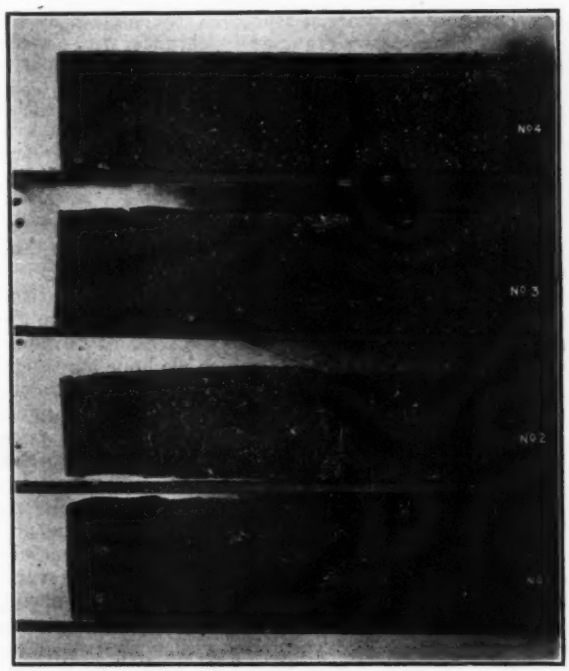


FIG. 4. FOUR STANDARDS USED TO CLASSIFY CELL STRUCTURE

Other cokes, fully equal in value to the above, are characterized by a peculiar shaggy appearance, as if they were covered with blotches of dark moss. This appearance is usually found in cokes produced from mixtures of eastern coking coals with the somewhat more highly oxygenated coals of the central field. Oddly enough, both types of coal usually make smooth coke if carbonized separately.

Certain cokes present transverse pebbly seams—usually not more than two or three. These seams are very narrow and quite coherent, and may be shown to be composed of small globules of quite pure carbon, with no apparent cellular structure. This phenomenon again appears to be characteristic of the more highly oxygenated coals.

The surfaces always show more or less transverse and longitudinal cracks, significantly at right angles—either parallel or perpendicular to the wall of the oven. Naturally these are an element of weakness, and their presence to an excessive degree is one of the surest "first-hand" indications of an inferior grade of coke that we have. The amount of fracturing can be controlled to a surprising extent by proper method of heat treatment.

By breaking a piece of coke and examining the fresh surfaces we find revealed the cellular structure that is characteristic of all cokes and which can not be seen in its true development simply by inspecting the dense natural surfaces. No definition of coke is complete that does not take this cellular structure into account.

The usual way—and the easiest—to examine the cell structure is to break a piece of coke crosswise and note the appearance of the fresh surfaces. Great care must, however, be taken, in comparing one coke with another by this method, to break the pieces at approximately the same distance from the wall end, since the size of the cells is apt to increase considerably from the wall to the centre. Oddly enough, in many cokes there is a characteristic difference in the two surfaces of a break. No matter where the piece is fractured, the surface on the wall side has almost a granular appearance, with a steel-gray lustre and well-defined cell openings. The opposite surface (i. e., looking toward the centre of the oven) has a characteristic graphite lustre, with the cell openings flatter and possibly not so sharply defined.

Importance of Cell Structure

Great importance has been attributed to the cell structure of coke by all authorities on the subject, and especially by blast-furnace operators, and yet the subject is very poorly defined and no standards of comparison have been established. We have recently begun the use of a simple system, analogous to the scale of hardness used in the study of minerals, which we hope may come into general favor. At present we employ a set of four standards, shown in Fig. 4. These are all longitudinal sections, cut from blocks of typically different coke. The sections are the same length, and each is cut beginning 1½ in. from the wall end. The sections are numbered 1 to 4 in order of increasing cell size. With such a set of standards it is easy to grade any coke according to its cell structure, and the grading will convey a much more definite idea than the loose terms of "dense," "close," "rather close," "fairly open," "medium," etc., that have hitherto been used. No term in our usual technical vocabularies has been so overworked as the word "medium," as applied to the cell structure of coke.

In addition to grading cokes according to the size of the cells, we may also classify them as regular or irregular in cell structure. The standards would all be considered as regular in structure. This does not mean at all that the cells are of the same size, but their general arrangement gives an easily perceived impression of regularity.

Specific Gravity and Porosity

It might possibly be thought now that an interesting table could be prepared grading the cell structure of cokes produced from various typical coals. Such a table would be well-nigh valueless, unless the data were carefully qualified by details regarding preliminary treatment of each coal, dimensions of ovens, temperatures, coking time, and several other factors, each of which plays a part in the development of cell structure.

Sometimes too much reliance is placed in the determination of the specific gravity and porosity of coke. Figures as to porosity or the percentage of cell space in the total volume of coke are almost valueless, unless supplemented by an examination of the actual size of cells and thickness of cell walls. A coke of close texture and thin walls may have the same percentage of cell space as one having large cells and relatively thick walls. As John Fulton the pioneer investigator of coke, said, 34 years ago: "Mere cellular space . . . cannot be used as an element in the practical determination of the value of cokes for blast-furnace use. Furnace gases cannot act on cell spaces; they can only act on exposed surfaces." It is the cell walls and surfaces that are the most important. Cell space and porosity, which is the measure of it, are merely incidental.

For ordinary purposes in grading cell structure magnification is unnecessary. Photographic enlargement gives some interesting information as to the character of the cell walls.

The actual chemical and physical state of the carbon produced from various coals under various conditions is an important matter from a practical standpoint. Differences in the true specific gravity of coke are frequently found that cannot be explained by variation in the content of inorganic matter. The actual condition of this inorganic matter after carbonization, the amount of reduction of the various oxides, the possible effect of the finely-disseminated mineral matter in strengthening or weakening the cell walls are all very important.

Inorganic matter does not necessarily constitute an element of weakness. Large particles, especially if segregated, are injurious, but finely-divided mineral matter may actually strengthen the cell walls.

High-ash cokes are frequently stronger than low-ash cokes from the same kind of coal. Some experiments in washing and coking coals of moderate ash content have shown that where the original coal gave a strong coke, the washed coal gave a weaker coke, the difference being undoubtedly due, to some extent, to the removal of some of the mineral matter, although the high moisture content of the washed coal might have had some effect. Simmersbach gives some evidence to show that iron present in combination with carbon and silicon, and silicon present as a silicon carbide, may be the cause of the remarkable hardness of some coke.

Studies of this character will, however, be largely of academic interest unless correlated with studies of the behavior of different types of coke in the blast furnace and in other types of apparatus in which the material is used.

News of the Gas Industry

Raise in Pennsylvania Rates

Pennsylvania gas will be sold for 37 cents the thousand after May 1, according to notices which were posted in the offices of the Pennsylvania Gas Company throughout Northwestern Pennsylvania recently. The advance will not come as a surprise as officials of the company intimated several months ago it would take place.

The new rate is virtually a five cent raise over the present one of 32 cents the thousand less two cents a thousand if paid before the 10th of the month. The same discount will obtain on the new rate.

H. H. McConnell, treasurer of the company, and head of the Warren office, could not say when approached whether the Pennsylvania had filed its new rate with the Public Service Commission.

It is believed the Public Service Commission will set a date for a public hearing on the new price.

The Warren & Chautauqua Gas Company will follow the example of the Pennsylvania and raise the price of its fuel to 37 cents a thousand, it is stated on authority.

Most of the company's patrons are located in and about Bradford and Warren.

Access Granted to Gas Works of Salem Company

At a hearing March 29 before the Massachusetts Gas & Electric Light Commission, on a petition of the Salem Gas Company to issue additional stock, Alton B. Adams, expert employed by the city of Salem and town of Peabody, stated that his investigations had been hampered by the company's refusal to allow him to inspect the property.

Albert E. Pillsbury, for the gas company, expressed the opinion that most investigations of the character are inspired by political motives, and that "hostile interests" should not have the privilege of promenading through a company's plant. He stated that the company had nothing to conceal. The delay of the municipal expert in presenting his case was unfair to the company, said Mr. Pillsbury.

Chairman A. R. Weed of the commission, said that Mr. Adams, being the city's agent, should have access to the plant. The commission would not order the company to admit him, but it should be willing to grant any reasonable request that would enable the facts to be procured.

Mr. Pillsbury replied that the matter was in the discretion of the directors. He, however, advised them not to admit the expert.

Commissioner Lewenberg asserted that the city's expert should have the right to examine the plant, as long as he conducts himself properly. "It doesn't make a bit of difference whether the company agreed to an inspection or not," he said.

Thereupon a conference ensued between Attorney Pillsbury, Colonel Hale of the company, and other officials present. On their return to the hearing room Mr. Pillsbury announced that out of courtesy to the commission Mr. Adams would be allowed to inspect the plant. He wished to know the extent to which the expert's inquiries would be carried. Mr. Adams stated that he sought a general knowledge of the company's property, its character and use. He had previously intimated that he considered the plant and property to be in excess of the company's requirements.

Toward the close of the hearing, Mr. Pillsbury registered a protest at the commission establishing a precedent of allowing interests inimical to a gas company to pry into its affairs. Chairman Weed asserted that the motive back of any application or protest before the commission was never to be taken into account in adjudicating an issue.

Lincoln (Nebr.) Rate Case

The question of rates for gas in Lincoln, Nebr., has been in litigation for some time between the Lincoln Gas & Electric Light Company and the city. The company enjoined the city in forcing an ordinance which was to change the rate from $1.20 per thousand cubic feet to $1 per thousand cubic feet, beginning in the year 1907.

The matter has been in the courts since that time, according to information received from G. A. Montgomery, vice-president and general manager of the Lincoln company.

The case was appealed to the Supreme Court of the United States, and the attorney for the city was anxious to have the case advanced, and last week argued in support of a motion to advance the case. Several weeks are expected to elapse before the court will decide whether to advance the case or not.

15,523 C. E-Z Lights Sold by 19 Men in 42 Days

The New Haven Gas Light Company has recently concluded a successful gas lighting campaign, featuring the Welsbach "C.E-Z" light. The company decided to utilize the "C.E-Z" with No. 747 shade, globe ring and by-pass and to offer this complete outfit for $2, payable 50 cents a month with the next four gas bills.

The net sales amounted to 15,523 lights and these were sold and installed by an average of 19 men in 42 selling days between Jan. 26 and March 17.

The Welsbach Company furnished the men with two supervisors and also gratuitously supplied a number of excellently designed advertisements which were run in conjunction with the company's appeals to its patrons through the various newspapers, including those published in Italian.

Gas consumers everywhere received the salesmen cordially. A large number of the burners displaced were of the open-flame kind, but many others were the cheap and unsatisfactory burners that had been purchased by consumers on account of low price without considering their actual service and efficiency.

By this campaign the patrons of the gas company have been brought to realize more fully the value and superiority of gas lighting and the advisability of accepting the advice of the gas company in regard to the appliances that should be used.

The lights were, as a rule, installed for inspection, "on trial." The wisdom of this plan was confirmed by the fact that the number of lights taken out was less than 3 per cent. of the installations, leaving the net sales as stated above.

This journal is indebted to Philmer Eves, advertising manager of the company, for the foregoing information.

Commission Rulings in Allentown-Bethlehem Gas Company Case

Rates, Minimum Rate and Reasonableness of Rates, Decided

In the litigation instigated by Fred G. W. Runk against the Allentown-Bethlehem Gas Company of Pennsylvania, in which he states that the company "charges and collects a minimum bill of 30 cents net per month for each meter, which set charge is illegal and the method of the collection of this charge is discriminatory," the public service commission has rendered the following decision:

Upon complaint made in regard to the minimum rate, and the rules and practices of the respondent, it was

Held: 1. The conveyance of the physical property only of a corporation incorporated by special act in 1855, to another which was incorporated under the Act of April 29, 1874, does not impose upon the latter the corporate obligations of the former.

2. When a gas company has for thirty-five years occupied the streets and alleys of a city with its mains, it will not be restrained from continuing such occupation upon the complaint of a consumer that its minimum rate is illegal.

3. That the rate charged by a gas company in one locality may differ from the rate charged by another company in a different locality, is not of itself, and in the absence of any evidence showing similarity of conditions, sufficient to prove that the higher rate is unjust or unreasonable.

By his petition Fred G. W. Runk complains that the Allentown-Bethlehem Gas Company "charges and collects a minimum bill of 30 cents net per month for each meter, which said charge is illegal, and the method of the collection of this charge is discriminatory." He also alleges that the price charged by respondent for gas in Allentown is too high, averring that there are companies in other cities furnishing gas at a lower price than respondent charges. There is also an allegation that the Allentown-Bethlehem Gas Company has no authority to engage in the business of manufacturing and furnishing gas to consumers in Allentown, and that the respondent company renders unintelligible bills to consumers, etc.

On hearing, it developed that the complainant was attacking the legality of the minimum rate rather than the reasonableness of the rate. There was offered in evidence an Act of General Assembly, approved April 10, 1853, P. L. 459, incorporating the Denowsky Gas Company. which provided that the price for gas furnished by that company in Allentown was to be a price to be agreed upon and not to exceed the average price charged in Reading and Easton. The complainant takes the position that the respondent company is the successor to the gas company and has no right to occupy the streets of the city of Allentown and render public service. It is sufficient to call attention to the thirty-fourth section of the Act of April 29, 1874, under which the Allentown Gas Company was incorporated.

Under that section gas companies were given the "right to enter upon any public street, lane, alley or highway, for the purpose of laying down pipes, altering, inspecting and repairing the same, doing as little damage to said streets, lanes, alleys and highways, and impairing the free use thereof as little as possible, and subject to such regulations as the council of said borough, town, city or district may adopt in regard to grades, or for the protection or convenience of the public travel over the same." Judge Sassaman, in the Consumers' Gas Company case, 17 Phila., 591, came to the conclusion that the thirty-fourth section of the act referred to gave gas companies the right to occupy the streets, subject only to reasonable regulation which the city might impose.

Gas Arcs Rented at Boston

The Boston Consolidated Gas Company has just taken up the practice of renting gas arc lamps by the year. The company furnishes the lamp, labor and material to make the complete installation free, on the customer's piping. Skilled employees are sent to clean the lamps, renew mantles and keep the glassware perfect, at regular intervals. The following are the yearly rental rates:

One lamp, $7.65 per year.

Two to 4 lamps, $6.75 per year each.

Five lamps and over, $5.85 per year each.

The company quotes the United States Bureau of Standards as its authority for stating that at 80 cents, the price in Boston, gas would cost 4 cents per 1,000 candlepower hours, while the cost of electricity for 1,000 candlepower hours given by the Mazda tungsten electric lamps is 10 to 12.5 cents.

The clear glass globe is recommended because it absorbs the least light, and because it does not change the quality of the light, but clouded or opal globes are furnished customers who desire them.

The gas arc appeals especially to storekeepers, restaurant proprietors, shops, offices and factories. The rental practice is expected to result in the permanent installation of gas lighting appliances in the great majority of cases.

Toronto Gas Riflemen Hold Annual Dinner

The annual banquet and distribution of prizes of the Consumers' Gas Company Rifle Association was held recently in St. James' Parish Hall, Toronto, Can., the chair being taken by the president of the company, A. W. Austin. This association has 364 of its members serving with the forces overseas, and the original membership of 441 has now dwindled down to about 60, all of whom were present last night.

A. Hewitt, general manager, made a short address.

The prizes were distributed by the president, whose silver cup is won this year by Station B Works team, with Hugh Thompson as captain. The following were the other prize-winners:

Works team, individual prizes—1, Hugh Thompson, 31; 2, Alf Johnston, 30; 3, J. Stauffer, 30.

Head Office team—1, H. Hutcheson, 32; 2, R. C. Paynter, 31; 3, E. W. Brown, 31.

Mutual Street team—1, Harry Bassett, 30; 2, J. T. B. Redferne, 29; 3, H. Cranbury, 28.

The evening concluded with a musical program rendered by some of the employees.

Twin State Company to Issue Bonds

The Public Service Commission has authorized the Twin State Gas & Electric Company, the public utility furnishing gas and electric service in Dover, and electric service in Berlin, N. H., to issue $31,000 face value of its 40-year 5 per cent. gold bonds for the purpose of paying indebtedness incurred in building additions and improvements to its plant. The general office of this company is located in Brattleboro, Vt.

THE FINEST LIGHTING STUDIO
IN THE UNITED STATES
At Your Service
Tomorrow morning, at 8:30 o'clock, The Gas and Electric Company will place at the service of the people of Baltimore the finest gas and electric fixture studio in the United States.
The whole second floor of the new Lexington Street Building has been devoted to this use for our customers who are interested in the decorative aspects of home lighting.
From the main floor of the building there are ample elevators to carry you to the second floor. From the elevator hall you will enter a large foyer. This is treated in the style of the late French Renaissance with walls of Caen Stone and Louis XVI. furniture especially designed to harmonize with the surroundings.
Here you will find a wealth of handsome table lamps, standard and portable lamps, of good design and craftsmanship, correct in their proportions and colors as well as in their mechanical manufacture and in the application of the proper principles of lighting to home illumination.
Surrounding this foyer are twelve rooms. These were designed by the architects of the building with the view of giving the proper assistance to the person selecting the fixture by showing it in association with the room decorations. In addition, these rooms abound in suggestions of simple, beautiful and inexpensive applications of the modern development of lighting for the home. Their range is so wide that they offer a field for the sensible selection of a lamp to meet any home requirement.
You will be particularly interested in the Colonial rooms. These period rooms are authentic reproductions. Orthodox in every detail, they present the chaste simplicity of line and the proper use of the plain surface which gives to the Colonial period its distinctive charm. The doorways in one of these rooms are reproduced from famous interiors in old Salem. From the ceilings, and about the walls, are to be found fixtures equipped with the most modern electric lamps, but designed after the fashion of those used in the Colonial house which was luxurious enough to boast of candelabra fixtures or oil lamps in fixture arrangement.
There are mahogany and oak rooms in rich, deep colors, equipped with the proper fixtures. There are bright, gay rooms in soft tones of gray, simply decorated with charming chintzes, as befits the modern country house, and contrasting with these you will find an Elizabethan room, paneled from floor to ceiling in dark English oak.
There is a particularly handsome room in walnut, after the English Renaissance style, in which are to be found a number of unusual fixtures suitable for the library or living room of dignity and distinction.
THE GAS & ELECTRIC CO.
LEXINGTON STREET BUILDING
Lighting Studio
SECOND FLOOR

ADVERTISING DESCRIPTION OF BALTIMORE'S LATEST UNDERTAKING.

Baltimore's Lighting Studio

The Baltimore Consolidated Gas & Electric Company has equipped the whole second floor of the Lexington Building, their new home, as a "lighting studio." It has been architecturally planned to give the maximum display and yet to set a standard for beautiful arrangement. A very good description is afforded in the above advertisement which was run in the Baltimore papers at the opening of the display. It is typical of their effective advertising.

Gas in an Emergency

The availability of gas cooking equipment for prompt emergency installation was recently illustrated in the case of a Boston restaurant whose entire baking plant was burned on Sunday, and the following Thursday morning the department was reopened. Gas baking ovens and hot food containers are a part of the new restaurant equipment referred to, all the dining rooms above the basement being gas equipped.

Prices for Connections and Hints on Range Purchases

The Boston Consolidated Gas Company has issued its range and water heater catalog for 1917. In addition to data and prices of various types of ranges—which include the Sentinel, Jewel, and Box Cabinet types—is a page given to rules governing the connection of ranges for domestic use, and one advising how to select a cabinet range. Kompak, Triplex and Automatic heaters are featured.

The Consolidated connects these ranges in kitchens of residences or first floor flats free, and when connected in kitchens above the first floor, the connection is made gratis if a proper supply of gas is obtainable from an outlet within the room; otherwise, additional pipe necessary for connection above 25 ft. will be charged for at 30 cents per ft.

Other suitable ranges may be connected within the kitchen for $5, and pipe exceeding 25 ft. is charged for at 30 cents per ft. When suitable meter connections are not provided, the company will furnish them for $8.

Flue connections will be made to the chimney within the room, when the range is connected on the chimney side, at $6, using 4-in. pipe; $7.50 for 5-in. pipe, or $9 for 6-in. pipe. Where the range is connected elsewhere in the room, 10 ft. of flue pipe will be put in at the above price; the balance, 25 cents per ft.

Free connections are made of heaters connected alongside upright boilers, the same rule as for ranges applying to extra pipe required. Where water heaters cannot be set alongside boilers, $4 is charged for water connections. Customer's own heaters corresponding to No. 8 Triplex are connected for $15, and for those corresponding to No. 7 Triplex, $19, subject to rules as regards location and gas supply. Meter connections are furnished for $8, and flue connections are made to chimney for $6.

On the question, what type of range is best to buy, the company advises the cabinet range, because the ovens are at a convenient height, thus enabling easy work. The ovens are used in preference to the top burners, with economy of fuel. The cabinet type is more easily cleaned, both under and around. Purchasers are advised to select a range with ovens large enough to cook the largest meal likely to be required in their household.

The New England Section National Commercial Gas Association Holds the Monthly Meeting at the Boston City Club

The meeting, held Mar. 23 at 8 p. m., was opened by George P. Smith, Jr., president of the section, with the appointment of the nominating committee to bring in names for officers and Board of Directors for the ensuing year. The committee was as follows:

R. C. Champion of Norwood, Chairman; C. D. Bond, Old Colony Gas Company, East Braintree; R. Y. Conklin, Gas & Electric Improvement Company; Mr. Hunter, New England representative of the Oriole Stove Company and L. C. Geffine, Welsbach Gas Company. This committee will meet and bring in names of nominees at the next meeting in April.

There was a very large attendance at this meeting to see the two moving-picture reels, one on the making of Coal Gas at the Minneapolis Gas Plant and another on the making of a gas range from the ore to the finished product by the Detroit Stove Works. A very interesting film for advertising purposes was shown on the screen, demonstrating an All-Gas-Kitchen. This reel was used by The Atlanta Gas Company for advertising in the local moving-picture shows.

At the finish of the pictures, Mr. Aaron, Eastern representative of the Detroit Stove Company, read a circular which he claimed to be the first gas stove advertising circular ever published. It was his belief that this circular was published about 1880 by the American Meter Company.

In it were many sales arguments and reasons for using gas ranges for domestic purposes that might be considered by our advertising managers of to-day. This company continued manufacturing stoves about ten years when their business was turned over to other manufacturers. Parts of this early type of range are still being called for, which speaks well of the make in those days.

Mr. Gifford, Manager of the East Boston Gas Company, was called on as the oldest gas man in the room, not in term of his age but on account of his long service in the industry. Mr. Gifford said that he was well acquainted with the stove of which Mr. Aaron spoke and that he believed that it was called the Goodwin Stove and that he became acquainted with the stove in 1881.

Mr. Gifford in his discussion of the pictures shown said that he was surprised to see a company as large as the Minneapolis Gas Light Company using hand stokers, that even in his small company they were charging the retorts with scoops using only about three scoops to a charge and they were considered antiquated.

E. E. Witherby, Gas Machinery Company, Cleveland, Ohio, said that making coal gas is as much changed to-day as any other part of the industry. In the old days retorts were charged every four to six hours. Now they are charged once in twelve to sixteen hours and instead of using three to four hundred pounds of coal to a charge are using 55 to 60 hundred pounds. Large companies are running three shifts of eight hours at the works, and I believe the eight-hour day has come to stay and that we will have to recognize the Adamson Law.

Some of our earlier ovens have been in use eight years without repair and our inclined ovens have been in use three years without any attention. Therefore, we believe that the new process with its minimized overhead is rapidly taking the place of the old type gas oven.

A discussion of the Gas Range with the Coal Heating Attachment followed, in which the Chairman called upon Mr. Woodhead, Manager of the Arlington Gas Light Company.

Mr. Woodhead stated that he tried to refrain from calling the Gas Range with the Kitchen Heater a Combination Range and had figures showing the merits of the Gas Range with the Kitchen Heater (as he called the so-called Combination Gas Range) over other types of combination Coal and Gas Ranges.

Mr. Woodhead thought that a serious mistake had been made in calling the new type of Gas Range with the Kitchen Heater a Combination Range.

In our territory, however, we have sold seventy-five ranges of this new type which we believe has taken the place of the old Combination Range. We have had the very best of results in every case and I have heard no good reason why companies should not handle this range.

Mr. Aaron of the Detroit Stove Company read a paper written by himself on the use of this type of range, in which he stated that in a town in the Middle West in 1916, five thousand Combination Ranges were sold and these were not of the Kitchen Heater type. No gas man would refuse to sell a Gas Range where a Coal Range was, and if we were to go into these homes during the winter months we would find the Gas Range covered over with a newspaper to keep it clean. This was not good business for the Gas Company.

Mr. Abbott, of the Weir Stove Works, stated that he felt there was a demand for this type of range, as his company was both in the Coal Range and Gas Range business, they are still doing business with the Coal Range and the Combination Coal Range with the gas attachment. If a dealer sells one of these Combination Ranges for $60 or $75 to a company consumer it will be a long time before the company will be able to get a Gas Range in its place, and I believe that a company ought to have this kind of business.

Mr. Woodhead again stated that it was not a loss to the Water Heater business, as the Water Heater had to be used in conjunction with this Coal Burning appliance.

Mr. Smith of the Old Colony Gas Company told how they had connected seventy-five Kitchen Heaters in the past and that it was his experience that they were no good as Water Heaters except in severe weather, as the fires were not run hard enough at other times to heat the water and we find that they do not hurt the Water Heater business.

These discussions proved very interesting and the program of the evening was brought to a close. The next meeting will be held April 27, 1917, at which time there will be an election of officers.

This journal is indebted to C. D. Bond, special representative of the Old Colony Gas Company, for the foregoing report.

Connecticut Company Buys Land

The Waterbury Gas Light Company has bought of Henry W. Hayden, of New York City, Florence S., James H., and Robert C. Hayden, of Caldwell, N. Y., two fair-sized strips of land on Railroad Street, Waterbury, Ct., in the vicinity of the Kalbfleisch Acid Works, and another strip of real estate in the same neighborhood from the Alden M. Young estate. The latter consists of nineteen acres. The deeds, which were filed with the town clerk's office today, stated that the company paid for each of the Hayden properties $3,820.

Manitowoc Company Has Reorganization

The Manitowoc (Wis.) Gas Company, which was recently taken over by C. N. Runyan, as was stated in the AMERICAN GAS ENGINEERING JOURNAL March 24, has just been reorganized. At a meeting held in Manitowoc it was attended by C. N. Runyan, of Grand Haven, Mich., new owner of the company, who was elected as its president. C. Ryall, attorney for the company, was also in attendance at the meeting.

J. P. Eastman, superintendent of the company, under the old management, was elected as vice-president and general manager of the Manitowoc company, which is one of thirteen plants operated by Mr. Runyan and his associates. Mr. Eastman will be in charge of the offices and plant of the company. R. C. Douglas, former president and manager, retiring.

Other officers of the company are Frank Wheeler, of Kendallsville, Ind., as secretary, and L. F. Ryall, of that city, treasurer. Kendallsville is headquarters of the Runyan interests.

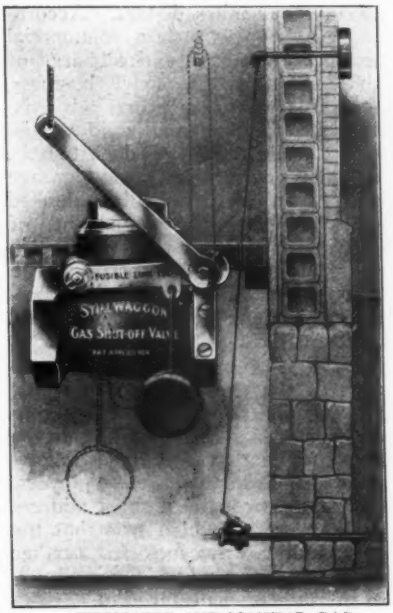
That the Manitowoc Gas Company, under its new ownership, has no connection with the Wisconsin Public Service Company of that state, or the Kelsey-Brewer Company, the Michigan syndicate, was a statement authorized by Mr. Runyan in reply to questions of the local news representative.

Gas Company to Engage in Coal Business

Manager R. B. Ingle, of the Perry Gas Works of Perry, Ia., stated recently his company had decided to engage in the retail coal business on an extensive scale and that in the future they would make it an important adjunct of their business in this city.

For the past year the sale of coke, one of the by-products of the local plant, has been handled by C. D. Marckres, but the contract has expired and the company will again look after the retailing of that product. Mr. Ingle states that every kind of coal will be handled, as well as the coke, that a delivery system will be installed and the wants of the people looked after thoroughly.

Orders for coke or coal will be taken at the gas works office, but suitable coal houses and storage rooms will be erected at the plant and the fuel delivered from there.



AUTOMATIC AND MANUAL GAS SHUT OFF

New Shut-Off Valve

The Stillwaggon Gas Service Shut-Off Valve manufactured by the New York Brass Foundry Company of New York City is a new safety device, which is unique in operation.

This valve works both automatically and manually, as is shown by descriptive cut.

Automatically: By a fusible link which melts at 150 deg. when the fire is in the vicinity of valve or meters.

Manually: From box which is set up against the front wall of building and by opening door of box and pulling handle the enclosed valve.

The valve is set in the service pipe inside of building on the inlet side of meter or meters, and is made in all standard sizes. The simplicity of this valve (there being no springs or intricate parts) and the small comparative cost are two of the features of interest to the gas company.

Pacific Company Will Spend Large Sum on Benicia Service

Seventy-five thousand dollars will be spent by the Pacific Gas & Electric Company installing a gas service in Benicia, Solono County, Cal., if enough signers can be secured.

J. A. Royster is representing the company and says he expects no difficulty in getting the required number, which is 400. A pipe line will be run from Vallejo.

Hot Baths for One Cent.

This sign in the display windows of Beloit (Wis.) Water, Gas & Electric Company, intended to advertise water heaters, elicited the following letter from a prospect and stumped the Beloit management as to just what course should be pursued in securing this lady as a satisfied customer. The letter as published in *Our Magazine*, issued by the Montreal Light, Heat & Power Company, is as follows:

BELOIT, WIS., May 26, 1916.

DEAR MR. LIONS—I see in your window an ad. for hot baths for one cent. I want to tell you, Mr. Lions that you've got the right pig by the ear. Being the mother of six children, three girls and three boys, it will be a real saving of time for me to send them to your bathhouse and have them slicked up. I have no city water in my house and have to carry well water from acrost the road which you know Mr. Lions is no fit job for a hard working woman, me being subject to rumatism in the jints. Now Mr. Lions what I want to know is, shall I send the children all on the one night or would you be better pleased to have girls one night and boys another or send one each night and is your bathroom open every evening and have you good attendants as I would not like to send my children to be bathed by anyone who would be rough and also I want them to be good and clean as summer coming on they get dirty playing on the street. Please let me know about nights you want the children to come and do they lug their own towels, soap and wash rags or do you have them.

P. S.—We have a toothbrush so you need not worry about their teeth.

Yours ever,
MRS PATRICK DOOIN,
Porter Avenue, Beloit, Wis.

P. S.—If my children report favorable on your baths maybe I will be down and take some myself. Do you make a special price for families?

Fox Lake, Wis., to Discontinue Plant

At a meeting of the village board of Fox Lake, Wis., held March 22, it was decided to discontinue operating the local gas plant after June 1, 1917. The gas plant has been a losing proposition for several years, and the consumption of gas has fallen off to such an extent that it will not pay to continue the plant.

Societies and Associations

THE INDIANA GAS ASSOCIATION will hold its annual meeting at the Claypool Hotel, Indianapolis, April 24 and 25, 1917, President G. M. Dolley of Logansport, presiding.

A banquet will be held at the Claypool Hotel on the evening of Tuesday, April 24, which will be under the direct supervision of E. J. Burke of the Citzens Gas Company, Indianapolis, who in the past has rendered this feature of the meeting a very delightful occasion.

The program arranged is as follows:

"President's Address," G. M. Dolley, Logansport, Ind.

"Be Careful First," illustrated by A. G. I. moving pictures, by J. B. Douglas, claim agent, United Gas Improvement Company, Philadelphia, Pa.

"Industrial Gas Business," R. A. Zeigler, Anderson, Ind.

"Gas vs. Electricity," C. N. Chubb, South Bend, Ind.

"Water Heated by Gas," W. A. Barrett, Indianapolis, Ind.

"The Development of Business Through Main Extension," W. H. Crawford, Hammond, Ind.

Members of kindred associations and all interested in the gas industy are invited to be present and a special invitation is extended to all Indiana gas men to become members of the association.

THE EMPLOYEE'S ASSOCIATION OF THE STANDARD GAS COMPANY HELD a meeting in Atlantic Highlands, N. J., April 3, 1917, which opened up seven new positions in that company. A meeting of the heads of the company recently brought out the fact that the business had grown so enormously during the past six years, that to facilitate the smooth running of further new business installations as well as attention to the old consumers, it would be necessary to re-adjust the old system of distribution and at the same time prepare for a larger increase in business in the next few years.

The Country Club at Atlantic Highlands, N. J., offered its club house, which is entirely an all-gas-one and the employees gathered there from the various districts.

Atlantic Highlands is the gas distributing point for twenty towns and extends to Freehold, N. J., twenty-four miles distant. According to the new plan a commercial manager will have entire charge of the securing of new business, demonstrations, solicitors, advertising, show rooms and window displays, while the fitting departments, installations, services, mains, garage and meter readers will be looked after by the superintendent of distribution. Each town will be in charge of a local superintendent, who supervises the work of its local fitters, helpers, complaint men and meter readers.

H. S. Stille, of Philadelphia, president of the company, attended the meeting and complimented the general manager, R. H. Garrison, on the fine co-operation and good fellowship displayed by the employees. Mr. Garrison made a short address the keynote of which was that the men could always look for further advancement as long as the good will of the public was catered to.

After dinner was served the value of modern gas appliances was shown in active operation in the club house The kitchen contains a one-section Vulcan hotel range and elevated broiler, a dish warmer and Reflex inverted lights.

The water is heated for the kitchen by an automatic Kompak heater and hot water is furnished for the showers, baths, etc., through a Ruud storage gas water heater, the dining-room is lighted by a No. 1607 semi-indirect bowl and a No. 1640 S. I. fixture, lights the reception parlor, C. E. Z. lights on artistic fixtures light the halls and other rooms, No. 10 outside Humphrey arcs illuminate the grounds.

This Journal is indebted to C. J. DeMers, commercial manager at Freeport, for the foregoing detailed report.

THE PORTLAND GAS MEETERS held their regular monthly meeting in their club rooms on Thursday evening, April 5, supper being served at 6.30. After the business meeting they were brought to the subject of Gas Water Heating which was given by E. S. Stack, a well-known water heater expert. With the aid of lantern slides Mr. Stack explained that various kinds of heaters and installations, which gave his audience a good idea of the numerous ways a water heater can be used. Everyone present, even the ladies who knew hardly anything of water heaters, acquired an abundance of interesting information on the subject, which was given in a most intelligent and clear manner. At the close of the lecture Mr. Stack was loudly applauded and a rising vote of thanks was extended him by the club. This journal is indebted to A. R. Andrews for the foregoing report.

THE NEW YORK SECTION OF THE GAS METERS GOOD FELLOWSHIP CLUB held a ladies' night at Elks Club, Brooklyn, Thursday, Mar. 29th. Under the guidance of chairman W. A. Burkle, the reception committee received about eighty members and guests as they entered the banquet hall where a delightful dinner was served.

Personal Notes

J. VINCENT MCCARTHY, who has been connected with the Dedham & Hyde Park Gas Company, Hyde Park, Mass., for some time past as salesman, has been appointed superintendent of the Natick office of the company.

G. I. VINCENT, formerly engineer of the Des Moines (Iowa) Gas Company, has been transferred to the Syracuse (N. Y.) Lighting Company as engineer of the gas department, succeeding S. J. Dickey. Mr. Vincent is among the engineers developed by the United Gas Improvement Company, which controls the Syracuse and Des Moines companies. Mr. Dickey was recently transferred to Philadelphia.

THOMAS SHAW, who for the past thirty-two years has been employed by the East Ohio Gas Company, Cleveland, O., takes great pride in the fact that he has never been late a minute in all his years of service.

WILLIAM J. LAPORTES, commercial agent of the Fulton County Gas & Electric Company, Gloversville, N. Y., for the past ten months, resigned recently to take a position as commercial manager of the Counties Gas & Electric Company, operating within the immediate vicinity of Philadelphia. Mr. LaPortes was presented with a dressing case by the employees of the company when leaving.

PAUL DOTY, general manager of the St. Paul Gas Light Company, St. Paul, Minn., has been commissioned a major in the United States Army Reserve Corps.

WILLIAM B. NICHOLS was elected general manager of the Citizens Gas Light Company, Quincy, Mass., at a recent board of directors meeting, to fill the vacancy caused by the resig-

(*Continued on page 16 of Adv. Sec.*)